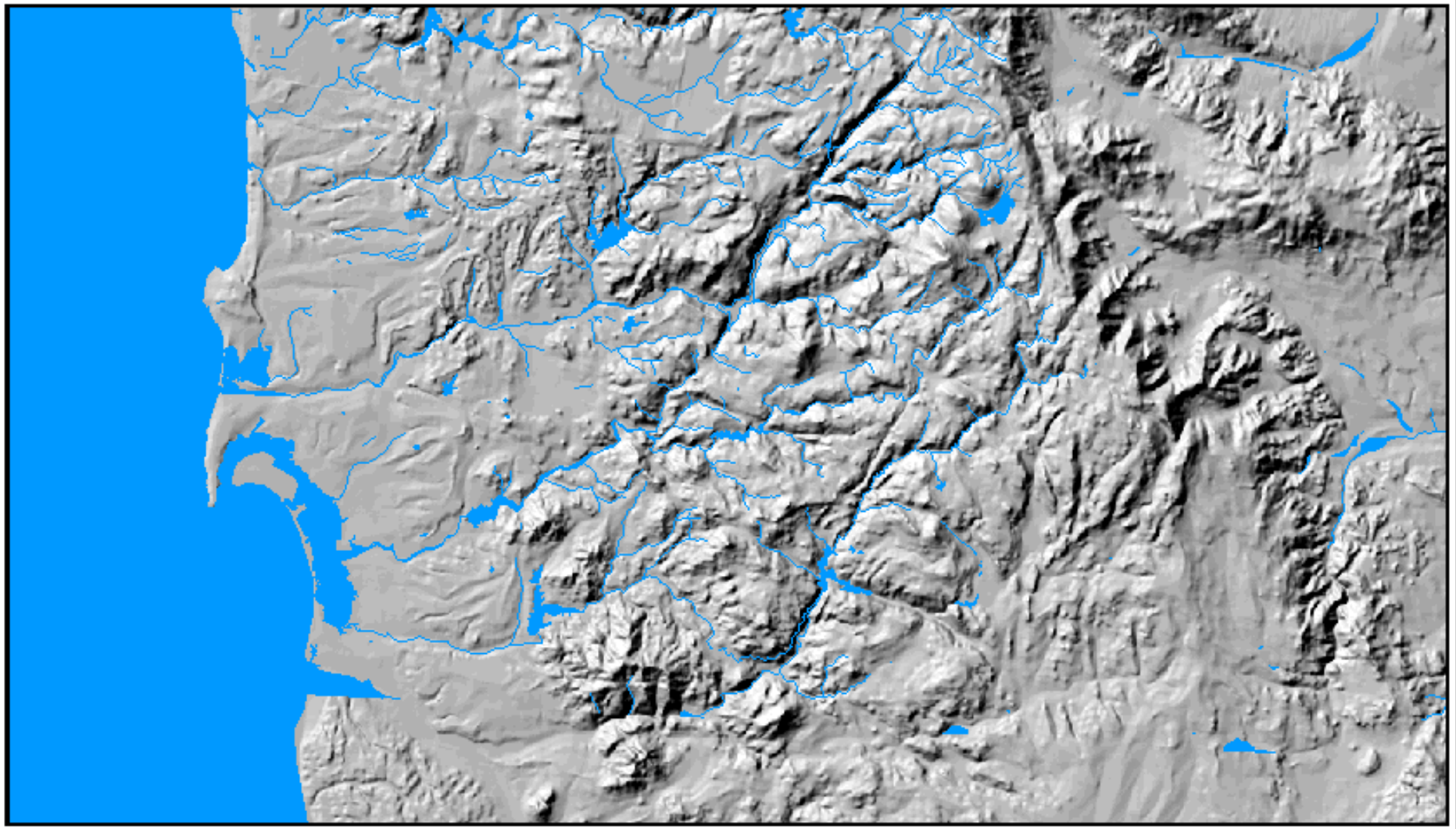
U.S. Army Geospatial Data and Systems (GD&S) Strategy

A Technical User's Perspective



PREFACE

This Report was prepared for Headquarters, U.S. Army Corps of Engineers, Directorate of Military Programs, Engineering Division, Architectural and Planning Branch, (CEMP-EA) by the U.S. Army Corps of Engineers, Forth Worth District. ICON, Incorporated, was authorized by the U.S. Army Corps contract DACA63-93-D-0017 Delivery Order Number 0019 to assist in the investigation and documentation. The Fort Worth District supervisory coordinator was Mr. Randall Mayne and the investigator was Mr. Thomas Speer, ICON, INC.

The effort is presented in the following framework on the issued related to the Army's use of Geospatial Data and Systems (GD&S); "where we are today", "where we need to be tomorrow", and insight on "how to get there". The effort was initiated by a direct tasking from Headquarters U.S. Army Corps of Engineers (HQs USACE, CEMP-EA) to Fort Worth District's Planning Division (CESWF-PL-E) to research and document the user's perspective of the GD&S technology within the Army's Engineering community. The views presented are those of a group of GD&S technical users referred to in this document as "Team GD&S".

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Executive Briefing:

An overview of the Army Geospatial Data Systems Strategy is presented in the executive briefing in Appendix A.

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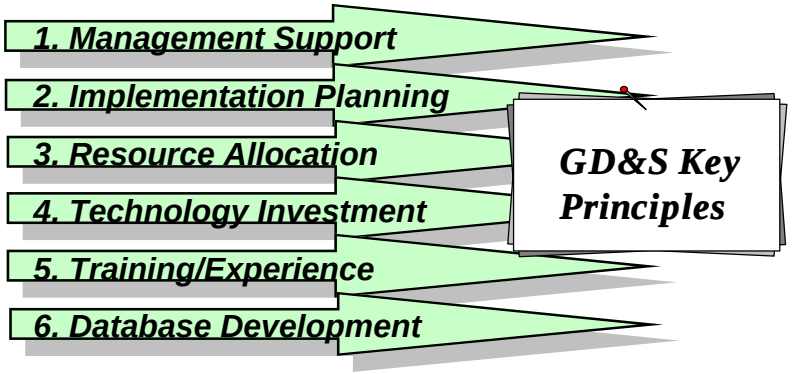
1) INTRODUCTION:

This report presents a "grass roots" (technical working level) perspective of the GD&S issues in the Army. Team members were selected from organizations with experience in fielding GD&S solutions in the Army (see Appendix C, "Background: The Strategies Initiative"). In addition to their technical skills and experience, an important factor was their ability to be objective and their willingness to work together across functional boundaries for the benefit of the Army. A contractor was included as a facilitator to provide technical input from the private sector and to document the issues.

Geospatial Data and Systems (GD&S) is defined by the Department of the Army, U.S. Army Corps of Engineers, Engineering Circular EC 1110-1-83 (ER 1110-1-8156) as "...any automated system that employs data referenced to a location on the earth, including Geographic Information Systems (GIS), Land Information Systems (LIS), Remote Sensing or Image Processing systems, Computer-Aided Design and Drafting (CADD) Systems, Automated Mapping/ Facilities Management (AM/FM) systems and other computer systems that employ or reference data using either absolute, relative, or assumed coordinates. These automated systems are collectively referred to as Geospatial Data and Systems (GD&S)." The Engineering Circular exempts architectural, mechanical, and electrical data and drawings inside the five-foot building line (and CADD systems used to develop such building data and drawings) with the exception of building footprints. GD&S systems are used to capture, store, display, manage, and manipulate graphical data. Geospatial Data and Systems provide installation personnel with the tools to automate the overlay mapping process which is the foundation of many site assessments, planning studies, environmental impact studies, and engineering design projects.

The findings of Team GD&S are presented and organized around six key principles that support the Team's vision for GD&S in the Army. The six key principles are:



1-1 GD&S Key Principles

Chapters six through eleven documents the Team's observation of the existing conditions in the Army related to the six principles and proposes specific goals, objectives and conclusions.

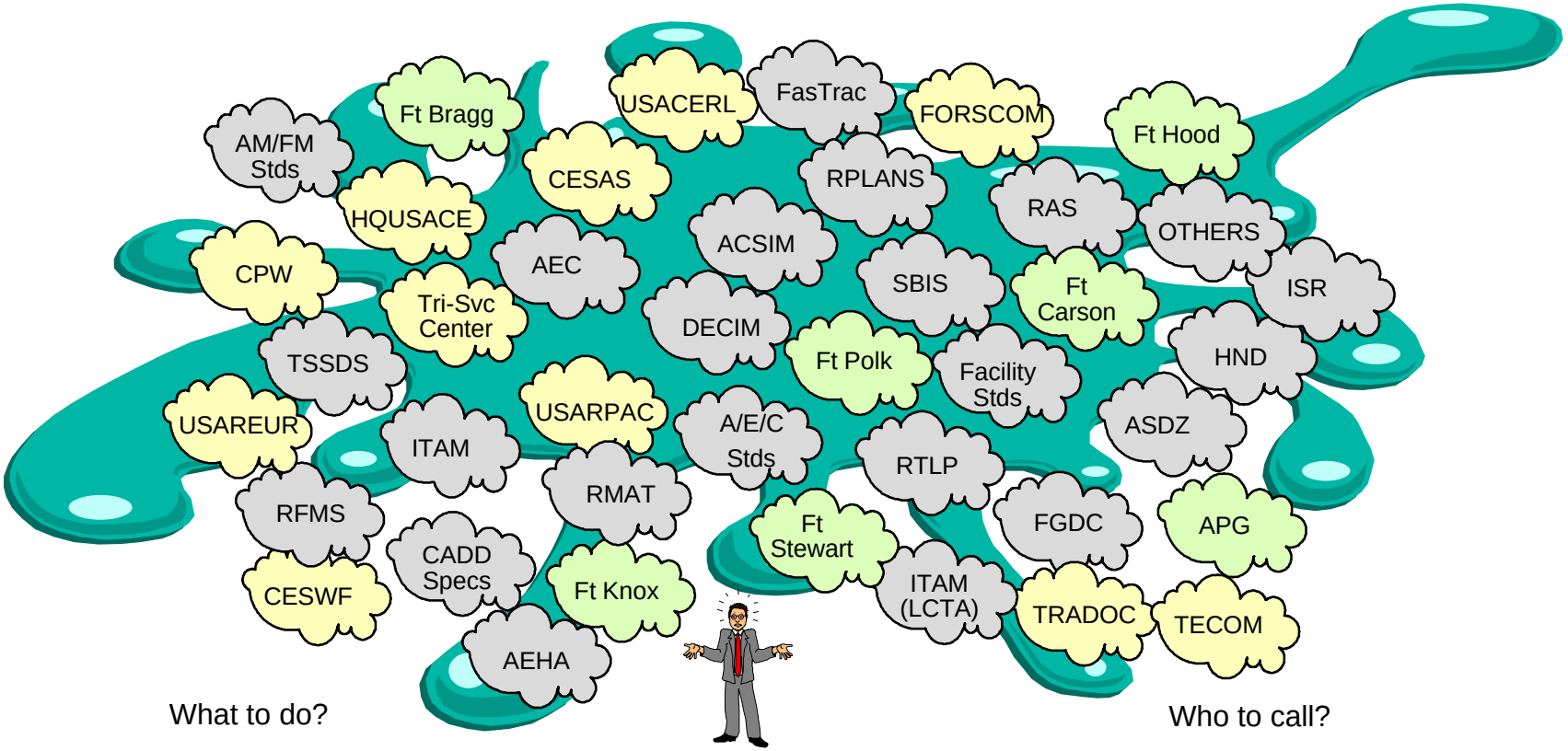
A. PURPOSE

This effort began with the purpose of identifying the existing GD&S conditions, where we are today, in the Army, where we need to be tomorrow, and how to get there, from the perspective of the technical GD&S user.

The team members shared their experiences and approaches to solving the needs of the user and evaluated each other's efforts. They gained direct and indirect input from installation staff, reviewed existing Army programs (Forces Command's Real Property Master Planning Initiative, Real Property Management Tool (RMAT), Range and Training Land Program (RTLP), and Tri-Service initiatives. Existing Army and Tri-Service surveys were also reviewed (References F, G, H, & I). The team evaluated the data, processes, reports, and products being produced by GD&S technology to support the Army's programs

or the end users needs. Many of the Team's initial observations were confirmed as the study progressed (Reference Appendix C, "Background: The Strategies Initiative").

Technical organizations within the Army (installations, districts, laboratories, etc.) implement the technology for particular processes or customers (bottom-up approach), often without knowledge of the efforts of others who are attempting to automate the same processes at other locations or for different customers. The Army has also initiated several headquarters "top-down" programs (Real Property Management Tool (RMAT) and others as identified in Appendix C) to implement technology at the installation. The Army has no framework or approach for capturing the requirements and needs that are common to both approaches. The multiple Army initiatives, combined with Tri-Service and Department of Defense GD&S initiatives, and the constant change in organizational structure in the face of reduced resources, presents a very confusing picture for the end-users.



INSTALLATION PERSONNEL

The organizations and systems identified above have contributed to the advancement of GD&S in the Army. There is no method of communicating, partnering, sharing of resources, or building upon each other's efforts for the benefit of the Army.

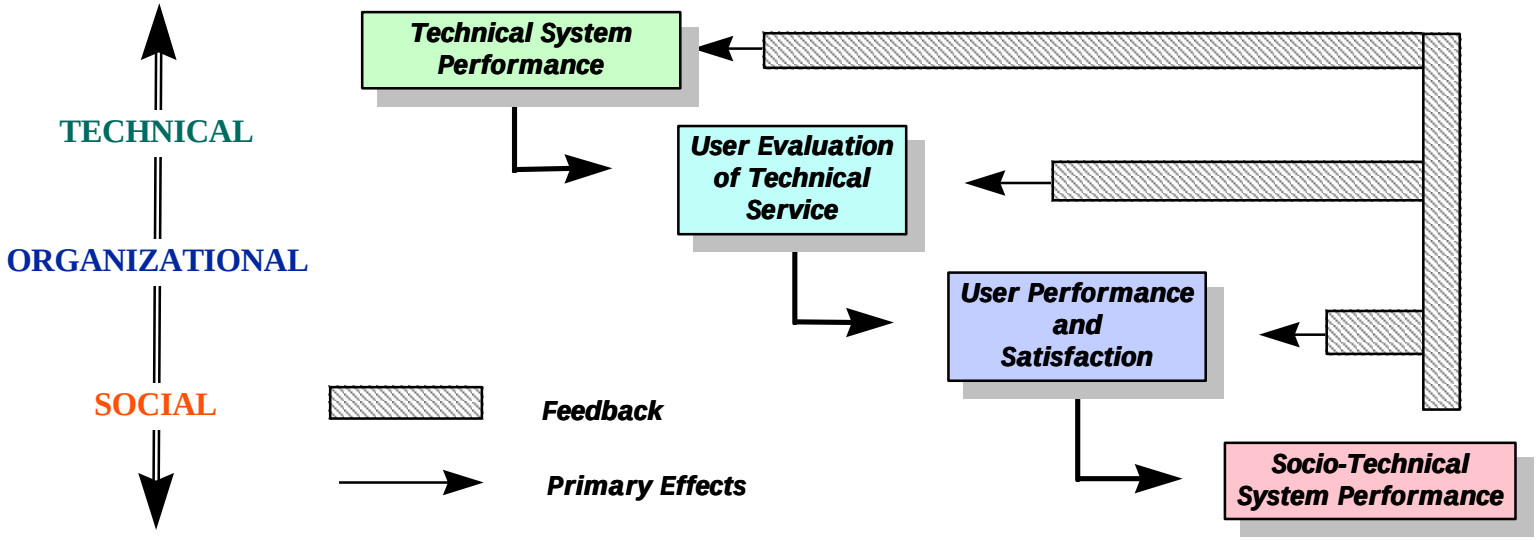
1-2 Implementation Guidance

Commercial vendors recognize this confusing dilemma and the lack of GD&S technical knowledge within many Army organizations. As a result, many vendors promote their products as "the answer to the problem". Many installations have purchased hardware and software, a "bag of goodies", as the solution to their requirement. This approach often results in a system that only meets a small percentage of the users' needs and overlooks their daily work needs. When the user recognizes that the solution only addresses part of their requirements, the vendors are waiting to sell additional software and hardware. This approach often places the vendor in a position of deciding what is best for the Army, instead of the Army tapping into its' expertise to determine its' needs and then conveying them to a vendor.

The Army's organizations and programs promote the development of vertical applications with a narrow focus. This "stove-pipe" approach, or the development of point solutions (single purpose solutions), is an expensive way to implement the technology because it only produces benefits for a few functions, processes or organizations. Maximizing GD&S benefits becomes more critical as resources within the Army are being reduced. Only when GD&S technology is used to integrate information and processes across functional areas are the maximum benefits realized and duplication of efforts reduced.

Implementing GD&S technology in the Army is more complex than just meeting the technical requirements (hardware/software) of automating a process or the production of a product. This fact is documented in a study that demonstrates that regardless of the computer platform, software suite, applications domain or military service, there are common social and technical factors predictive of successful Geographic Information adoption. (See Figure 1-3 and Reference "An Exploratory Analysis or Responses to Geographic Information Adoption on Tri-Service Military Organizations", Reference item "I".)

This report identifies a strategy for the technical, social, and organizational issues that the technical user believes is important for the implementation, integration and sustainment of Geospatial Data and Systems as a tool to assist the installation staff in the performance of their daily tasks.



1-3 Evaluating GD&S Technology

The Team has presented the issues (technical, social, organizational) within the Six Key Principles. Measurable metrics for evaluation and monitoring of each of the principles should be established for the implementation and sustainment of the technology within an organization. The six principles require evaluation relative to a person's perspective within an organization and can be applied to an installation's specific functional area (Real Property Master Planning, Range and Training, Environmental, etc.) or collectively, as a corporate approach for all activities at an installation. The report recommends strategies that can be implemented to help the Army and installations determine what is needed to maximize geospatial data investments.

The Team's purpose in documenting the enclosed strategies is that we believe the Army cannot continue to implement the technology without identifying a strategy and measurable benefits to be gained prior to initiating a GD&S effort. Our hope is that this document will serve as a catalyst for increasing the awareness of the issues within the mid-to-upper level management within the Army and to gain support from other GD&S users in the Army. Beyond establishing an awareness, the Team would like to challenge the Army organizations (ACSIM, CPW, HQUSACE and the installation staff) to acknowledge the issues and work together to develop action plans to execute the agreed upon priority objectives. After management and technical users agree on these objectives we would hope that the two staff levels would work together and across functional boundaries to develop and execute the action plans.

The most common type of GD&S used within the Army is CADD systems. In the past there were clear distinctions between the various levels of system capabilities (ie; CADD, AM/FM, and GIS). Today, technology has blurred these differences, while there are still some differences, Team GD&S refers to them as levels of complexity under the term GD&S. The selection of one type of system over the other is not the issue. **The important question is, "which type of system will meet the user's requirements?"** The initial implementation of the technology should satisfy the user's most frequent and immediate need (see Reference D), then grow to accommodate more complex requirements.

2) ARMY GD&S VISION:

The importance of Geospatial Data and Systems (GD&S) has increased dramatically over the past several years and will continue to increase into the foreseeable future. The Army is currently facing the challenges of stewardship and compliance requirements with reduced resources, while strategic Army initiatives continue to grow. The Army is implementing programs focused on: environmental stewardship; housing and training a total force; improving quality of facilities and services; planning for the use of facilities; and becoming a valued neighbor in the community. The importance of Geospatial Data and Systems will continue to increase and impact the success of future Army initiatives and programs. GD&S technology is a common element in many initiatives and is of such importance that it requires a wholistic approach across the programs within the Army.

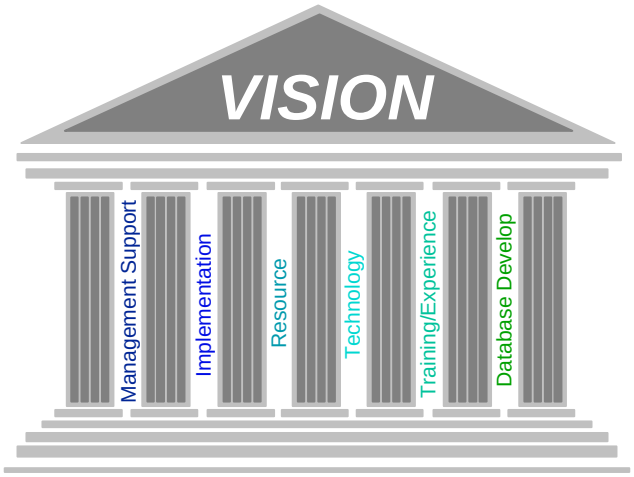
Team GD&S has prepared the following mission statement.

The Army's GD&S vision is to implement GD&S technology at all installations as part of a corporate environment that maximizes current investments and allocates resources that are required to collect, edit, maintain, and use the GD&S technology to reduce costs and improve the quality and usability of installation geospatial data.

To achieve the vision the Army must focus on the following:

Establishment of a corporate framework for implementation and sustainment of Geospatial Data and Systems technology that integrates the requirements of the technical user at the installation level and existing Army programs.

Throughout the investigation and analysis of existing conditions by Team GD&S, six key principles have been identified that support the vision of the future: establishment of management support, development and execution of implementation plans, obtaining resources, investment in the right technology, increasing experience/knowledge within existing staff, and maximizing installations' geospatial databases.



2-1 Army GD&S Vision

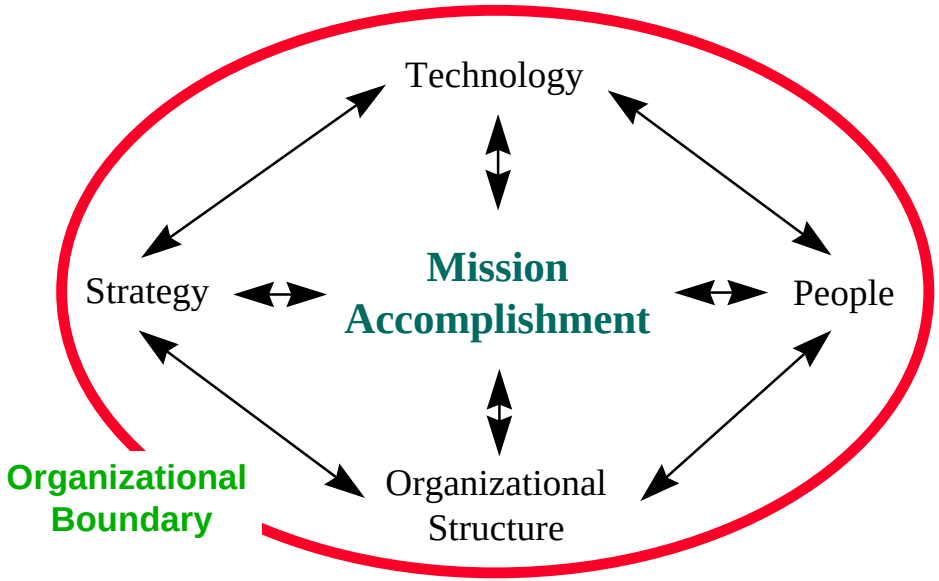
3) GOALS - "What"

To accomplish the Army's GD&S Vision, as stated on Page 2-1, some overall goals have been drafted to identify "what" should happen, from a grass-roots perspective, to accomplish the vision. These goals were derived from several of the key words in the GD&S vision:

- Develop GD&S within a corporate framework;
- Maximize current investments;
- Balanced allocation of resources relative to the six principles;
- Reduce costs;
- Improve user friendliness and frequency of use;
- Improve the quality of data;
- Integrate the technical user's requirements into existing Army programs.

In the past, the Army has implemented their GD&S applications within a particular directorate to automate a specific process or produce a product (ie. master planning, environmental management, space utilization, etc.) focusing only on the technical issues (hardware/software). Organizations would acquire hardware/software and train personnel without considering an overall strategy for all the components, how to sustain the investment within their organizational structure and manage the impacts on the people adopting the technology to support their mission.

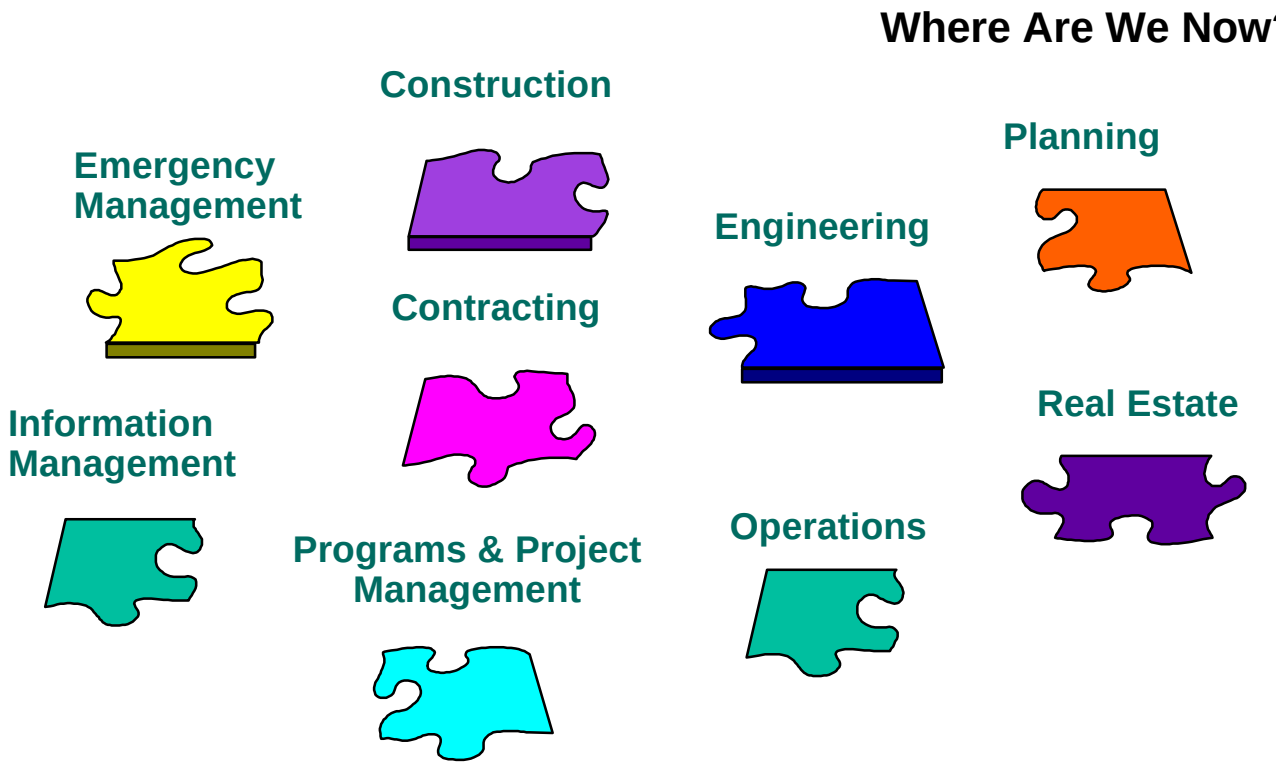
The Components of GD&S Must be Focused on the Mission of the Organization



3-1 GD&S Components and Organizational Mission

Organizations involved in implementation efforts have been reluctant to look beyond their organizational boundaries to see the corporate (installation) picture. Organizations have implemented the technology without interfacing or building upon other activities' efforts within their own installation or in the Army. In the climate of declining resources the Army's organizations can no longer afford to be totally self-serving in implementing GD&S technology. There is a danger that reduced resources and fear of cutbacks will cause organizations to entrench themselves further instead of partnering and sharing lessons learned as a way of executing their mission using GD&S. The Army must capitalize on the investments they have made to date by partnering, sharing lessons learned and moving forward within a corporate framework toward a vision.

An analogy of the GD&S environment in the Army is that of "islands of expertise in a sea of ignorance". The "islands" are analogous to the organizations within the Army that have successfully adopted the technology and possess GD&S expertise.



"Islands of Expertise"
Within the **Traditional** & Organizational Boundaries & Stovepipes

3-2 Islands of Expertise

The "sea" represents organizations that want to implement the technology. These organizations typically charge forward unaware of or refusing to recognize the completed efforts and lessons learned that they could build upon. The challenge for the Army is to empower the "islands of expertise" by developing a corporate framework where organizations would work together to develop an awareness of the issues and to mentor GD&S expertise to help others execute their mission. Based on this challenge the GD&S goals are:

1. Establish leadership roles and responsibilities within the Army with regard to the adoption of Geospatial Data and System implementation.

2. Establish a Corporate Army Geospatial Data and System Strategy.

3. Provide reliable Spatial Data and Systems that are easily accessed and frequently used.

4. Promote seamless integration of technology and mission.

5. Improve mission performance (quality and productivity).

6. Promote sustainability of the technology within Army organizations.

7. Reduce the cost and increase the return on investment (ROI) associated with the development and implementation of Geospatial Data and System technology.

8. Implement an Army GD&S "Regional" Support Plan for military Installations.

9. Develop an awareness and a commitment to the optimum level of GD&S automation required at each installation and the adoption of a regional support plan.

3-3 Vision and Goals

4) OBJECTIVES - "How to Accomplish Goals"

There is an emerging necessity (due to the increasing complexity of compliance issues and constraints that affect installations' operations) to establish and provide corporate direction for the implementation of Geospatial Data and System technology at Army installations. Installations are concerned that the Army is building new top-down systems that are not compatible with the system(s) that have been or are being implemented. They realize that these new system(s) will cause their current investments to be wasted, or that the installation will incur more time and costs from their installation funds to implement the top-down system(s). Because the installations must meet demands that they face in their daily environment, they make decisions without a clear understanding of a Corporate Army strategy for the evolving technology and programs within the Army. The Army must develop an approach where the technical daily requirements of the installation users can be met in concert with the top-down driven GD&S efforts.

To accomplish the goals stated in the previous chapter, the following objectives have been drafted to identify "how" to accomplish the goals:

1. Formulate an evaluation, review and tracking process, based on the "six key" principles (Refer to Chapter 5), that will identify an organization's opportunities and constraints for achieving benefits from implementing GD&S technology.

2. Implement Continuous Process Improvement for refinement and distribution of engineering GD&S workflows.

3. Develop and fund a plan for the Army to implement the Tri-Service Spatial Data Standards (TSSDS).

4. Establish and fund an Army Geospatial Data and System Technology Team.

5. Implement a method to share (co-resource funds and expertise) for GD&S initiatives across organizational boundaries to reduce duplication and develop a set of corporate tools and processes.

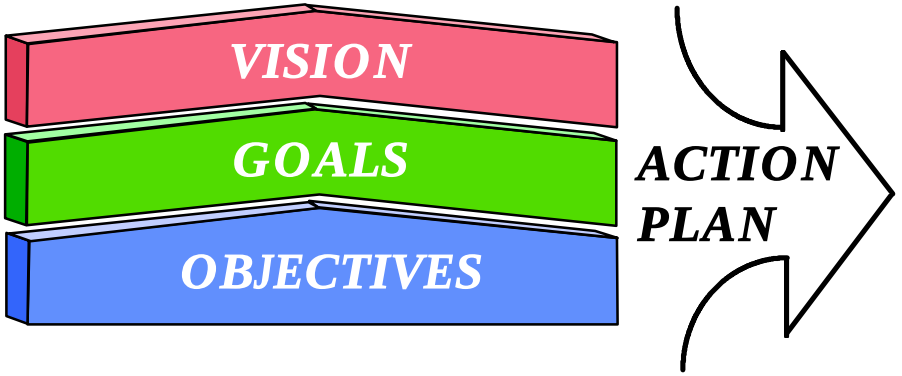
6. Identify the critical role of spatial data in one's mission.

7. Establish an awareness in personnel (management and technical) that are affected by the implementation of the technology and the GD&S life cycle.

8. Utilize existing Army and Tri-Service GD&S resources.

4-1 Vision, Goals, and Objectives

Team GD&S has identified a vision and many goals and objectives. The team is hopeful that the appropriate Army organization(s) and the user community will embrace the strategies and work together to develop action plan(s) to implement the concepts.



4-2 Action Plan

5) GD&S PRINCIPLES

A. OVERVIEW OF THE SIX KEY PRINCIPLES

There are six (6) key principles that the Team has identified that require evaluation and monitoring to increase the chances of successful Geospatial Data and Systems implementation and sustainment. The principles represent a combination of the team's experiences and input from many installations' efforts.

1. Management Support (Chapter 6)

Management support is the most important principle that determines the success of GD&S at an installation. Management support represents the willingness and ability of the organization's management to support the implementation and sustainment of GD&S technology. It is key to ensuring that the GD&S technology receives the required resources and political support within an organization(s).

2. Implementation Planning (Chapter 7)

Implementation Planning represents the preparatory planning tasks that are required to successfully install and operate GD&S technology within an organization. The planning process is an evaluation of the organization's, establishment of goals and objectives and the identification of the resources required to implement the technology. The plan becomes a road map and a tool that is used to guide the organization through the process while establishing metrics for the evaluation and monitoring of the effort.

3. Resource Allocation (Chapter 8)

Resource allocation represents the time, manpower, and funds required to implement and maintain GD&S technology. There should be a balance of the three resources within an organization. The resources that an organization(s) will need to implement the technology are identified during the implementation planning process.

4. Technology Investment (Chapter 9)

Technology investment represents the required hardware and software that an installation must purchase to establish a GD&S platform. There must be a balance between what the installations purchase and what they require to achieve their goals. The proper level of investment in technology should be determined during the mid-to-latter part of the implementation planning process.

5. Training/Experience (Chapter 10)

Training and experience represent the skill levels that must be acquired by installation personnel to effectively utilize GD&S technology. Installation staff must acquire the knowledge and experience necessary to perform their existing duties and to be prepared to face tomorrow's challenges. There are many functional areas that can benefit from GD&S technology, but the level of knowledge and experience necessary to implement and sustain the technology must first be obtained.

6. Database Development (Chapter 11)

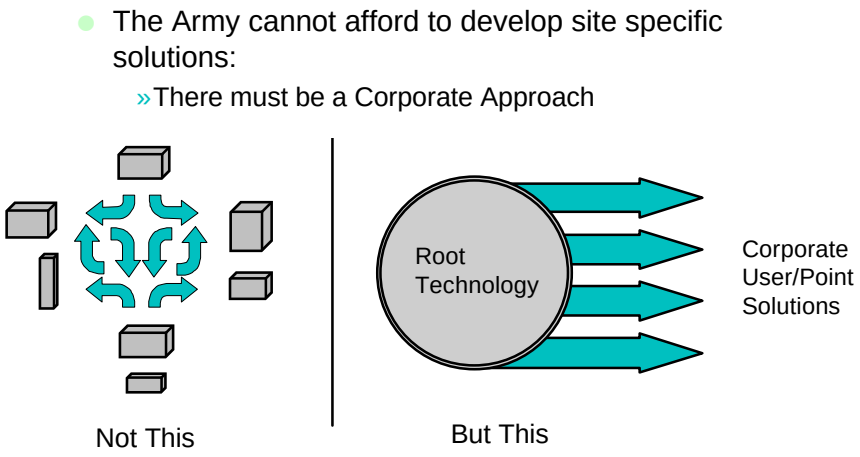
Database development represents the required graphic and tabular information collected and converted into a data model for a geospatial data system. The appropriate and accurate data for the desired application often is the most expensive investment. The Tri-Service CADD/GIS Center in Vicksburg, Mississippi has compiled most of the essential geospatial data elements in the Tri-Service Spatial Data Standard (TSSDS) for planning level applications. The TSSDS data model should be used as a baseline organization for the installation's geospatial data.

B. GENERAL THEMES

Prior to explaining the "Six Key Principles" in detail, there are several concepts that apply to all the principles; Corporate Approach, Root Technology and Co-Resourcing. These concepts are discussed in the following sections.

1. Corporate Approach

The majority of the spatial data systems that have been developed within the Army are a result of "point solutions". A point solution is often initiated by an individual or organization (branch directorate, division, or MACOM). In the past, these efforts often included substantial funding. These approaches were acceptable at the time and yielded some big dividends. However, as more people within an organization require access to geospatial data, this approach begins to break down because efforts from one "point solution" are rarely compatible with another. In addition, as resources (funding and personnel) continue to decline, the Army can no longer afford to invest large sums of money for point solutions that serve a select few within an organization.



5-1 Corporate Approach

The top down and bottom-up initiatives are encouraged and required. Today the Army has the many point solutions that have been developed, some of which are actually used by installation staff. The programs and requirements continue to come from the top. There is no attempt to capture the "islands of brilliance" (the successes) and incorporate them into an overall approach (strategy) at the various levels within the Army (DA, MACOM, installation wide, or from one installation to the next).

A method for establishment of a corporate framework should be developed with input from the technical (working) level and the mid-to-upper management (top-down requirements) to address the proliferation of point solutions in the Army. An Army GD&S corporate strategy for maximizing the use of the technology across organizations would address this issue. A corporate approach would include the establishment of a method for the Army to transfer technology and identify opportunities for partnering across organizational boundaries. Team GD&S's recommendation is that a technical users' team should be developed and supported to work with headquarters, MACOMs and the installations to assist in capturing the successes for the benefit of the entire Army (refer to Page 5-11, Role of a GD&S Technical Team).

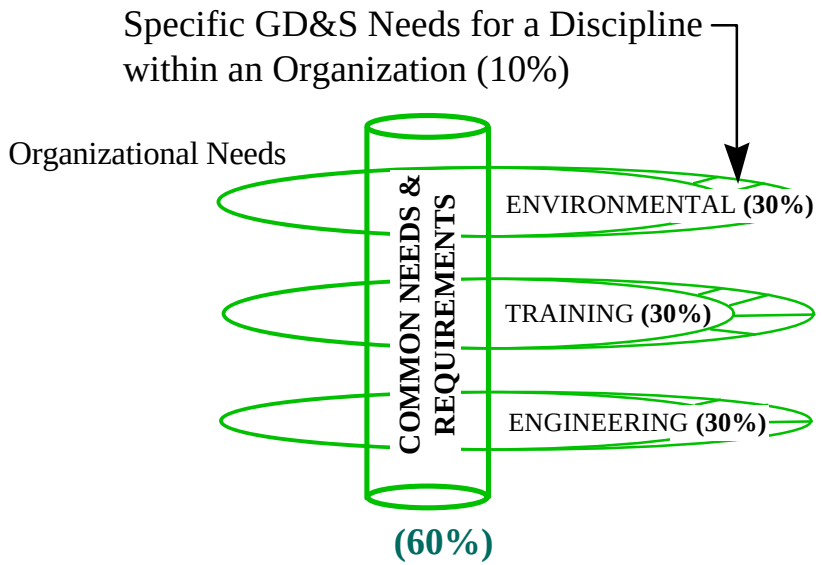
Organizations that have the technical expertise, funds and management support to develop a GD&S application should be encouraged to do so, with one exception. Prior to startup, during development, and as products are produced and lessons are learned, they should be encouraged to communicate with an Army GD&S technical team.

A Technical Team would facilitate and encourage other organizations to communicate with the Team for the purpose of identifying opportunities for partnering, technology transfer, or lessons learned. As a result, the original effort may receive additional funding to advance it to an enhanced level of development while adhering to the Army's corporate approach. The "Army's root technology" would be

incorporated as the building blocks for the development of the product and, upon completion, would enable the application to be used at multiple locations. Over time, the Army would be building an RMAT type solution one step at a time, while incrementally fielding usable products at the installation level.

A corporate approach should be adopted for various levels within the Army (Headquarters, MACOMs, installation, etc.). The development of a corporate approach should start at the organizational levels within an installation. Then as common requirements and needs are identified across functional organizations they should be rolled up to form a corporate approach for the total organization. The specific goals and objectives of a particular directorate should dovetail into the total organization's corporate plan/approach and then the Army-wide corporate approach.

Headquarters, Naval Facilities Engineering Command briefed Team GD&S on their analogy of their 60/30/10 percent approach. This analogy can be applied to develop a corporate approach. 60% of the requirements and needs of an organization for a GD&S application are common across multiple organizations on an installation. 30% of the requirements are specific to an organization's mission. 10% of the requirements are specific to the discipline within an organization. The percentages are representative of the fact that there are common requirements across organizations within an installation. The GD&S technology should then be developed to meet the common needs and requirements of the organization. This approach will maximize the frequency of use of the system and reap more benefits.

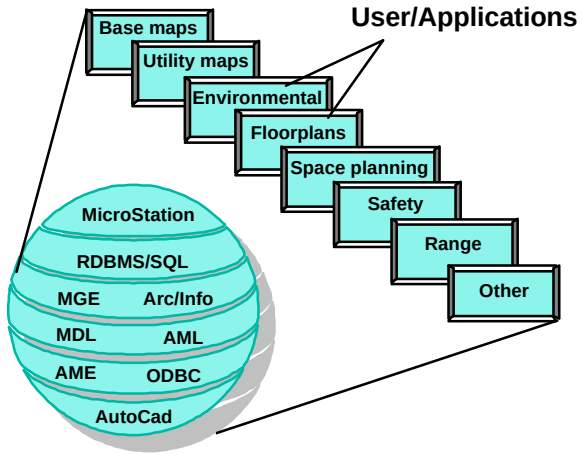


5-2 60/30/10 Concept Applied to A Corporate Approach

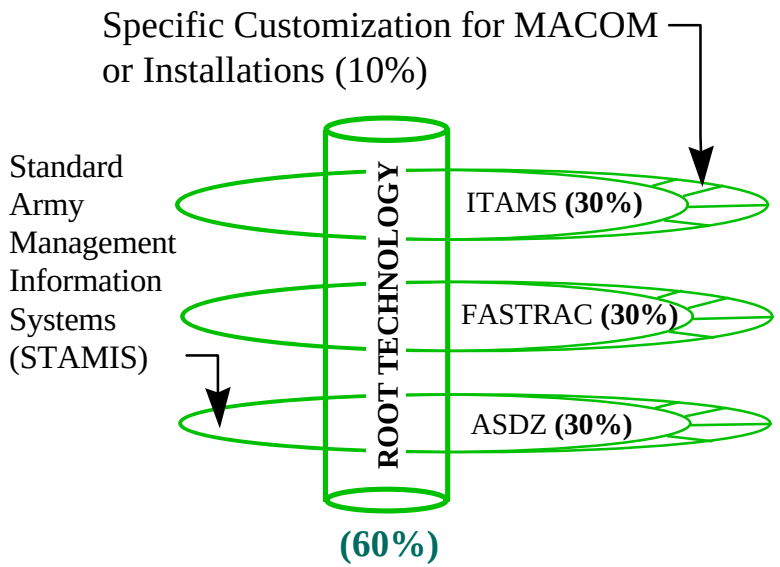
2. The Root Technology Approach

The Army should identify a tool box and a review process for the implementation of Geospatial Data and System applications. Team GD&S has labeled this approach the "Root Technology" approach. The first step in the implementation of a Root Technology approach would be to develop a process to identify the root technology components (specific CADD engines, GISs, database formats, user interface requirements, interoperability requirements, etc.).

- GD&S Root Technology:
  - »MicroStation
  - »AutoCad
  - »Arc/Info
  - »MGE
  - »MDL, AML, AME
  - »RDBMS/SQL
  - »Open Database Connect (ODBC)
  - »Other



5-3 Root Technology



5-4 Root Technology & the 60/30/10 Concept Applied to STAMISs

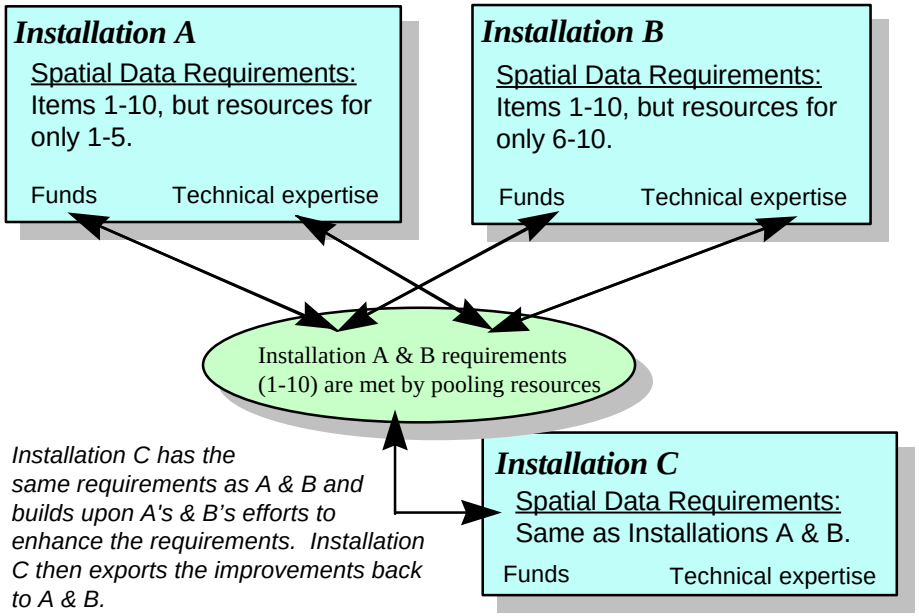
The root technology would become the "tool kit" from which all GD&S applications would be developed if the application was to become a Standard Army Management Information System (STAMIS). Then a process should be identified whereby the applications are prototyped and tested by technical users prior to being fielded or becoming a STAMIS. This approach would also build an environment of interoperability across applications and organizations within the Army.

Such an approach, or a similar one, would increase the benefits from the GD&S investments by reducing duplication, building upon others' efforts, and the production of products and processes that can be used throughout the Army.

Implementation of a root technology approach would promote new development by commercial vendors and the Army would receive a greater return on its investment. Commercial vendors will then be stimulated to develop Root Technology that shares data across vendor specific platforms and applications and that will promote integration into an installation's existing systems.

3. Co-Resourcing

Co-resourcing is a concept of partnering across Army organizations (MACOMs, installations, directorates within an installation, labs, engineering districts, etc.) to share technical resources and funding. Co-resourcing should be an option considered when common goals and objectives are identified for the benefit of several organizations or installations. Many GD&S requirements are common between organizations an installations. The concept of "co-resourcing" applies to the sharing of funding and technical knowledge for common needs.



5-5 Co-Resourcing

a. Funds

In today's environment, individuals redefine, reinvent and implement solutions within their own environments, unaware of similar initiatives and without a framework to enable them to build upon others' efforts. This climate fosters the proliferation of "reinventing the wheel" and wastes resources.

When a co-resourcing opportunity is identified, actions should be taken to share funding so that applications can be developed that meet the requirements of all participants. Participants of a co-resourcing effort would work together to determine the 60% requirement (needs of all), the 30% (needs related to the application but specific to an installation), and the 10% (needs related to a specific directorate at an installation). The participants would then formulate an action plan that would benefit everyone.

b. Technical Expertise

Many organizations within the Army have developed in-house GD&S expertise. This pool of knowledgeable Army organizations should be identified and published for use by others. When an organization is developing a GD&S application, it would be beneficial to know who has developed similar applications. This knowledge would provide an opportunity for an agency to gain insight into "lessons learned" and possibly provide a resource to assist them in the execution of their application. It is often helpful to obtain input from unbiased government experts who have no benefits to gain by stating their observations.

Another benefit of teaming with Army technical experts is that the experts would be in a position to mentor their knowledge to others on the team. Co-resourcing of technical knowledge reduces the need for individual organizations to develop their technical knowledge from scratch by allowing more experienced personnel to mentor them to a desired skill level.

Knowledge gained by working with, and being mentored by, technical experts would allow the other members of the team to execute the task themselves when similar applications were required for future projects.

Over time, the technical experts that exist within the Army would be in a position to apply their skills to a wider customer base, which would reduce the cost of GD&S implementations for the following reasons:

1) Experience - When technical knowledge of an application is gained, application of the lessons learned reduces the costs.

2) Mentoring - The mentoring of knowledge beyond a few individuals or organizations benefits the Army as a whole.

3) Sustainment - When organizations with GD&S requirements work closely with others, they gain first-hand knowledge that enables them to more efficiently maintain the system.

c. Co-resourcing With Others

The Army should broaden their perspective with regard to their relationships with others (private sector, academia, other government organizations) to identify partnering opportunities. The private sector has applied a concept known as co-sourcing (Reference item "K") where a business partner shares a client's project risks and makes financial and management investments in the project. The business partner's revenues and profits are based on achieving mutually agreed upon measurable benefits. This approach shifts some of the responsibility for success from the client to the business partner.

The Army should identify a framework which would enable Army organizations to form pro-active partnerships with the private sector, academia, or other government organizations to improve the functionality of Geospatial Data and Systems within the Army. The assembling of teams, or organizations, comprised of a combination of government, private, and academia could offer some very powerful opportunities for all participants.

Many existing solutions outside the Army could be applied to a military installation. When specific organizations outside the Army have GD&S skills, the Army laws and regulations should allow them to partner for the development of Army GD&S applications. This participation could include cost sharing of federal and private funds.

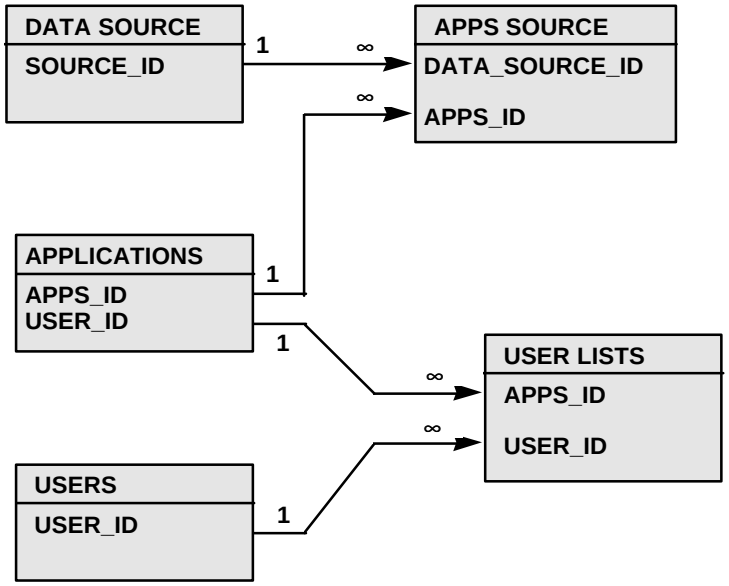
C. GD&S Relationships to: Functional Areas/Processes/Products

a. The Data-Application-User Model

Data is the heart of any GIS system. Data collection is both time consuming and costly. Therefore, it is essential to identify the applications that the GIS will support, the data necessary to perform those applications, and the users who maintain and use the data. One way to cost effectively accomplish this goal is to develop a Data-Application-User Model that establishes the relationship between application, required data and user. The model captures required applications, required data to complete an application, and which users will benefit. It also provides a tool for prioritizing the data to collect so that the maximum benefit for data collection dollars may be achieved.

b. Steps for Developing a Data-Application-User Model

1. The first step in developing a model is understanding the relationships between the data being modeled. This model contains User specific data, Application specific data and Data specific data. The relationship between Users, Applications, and Data is that many different users use multiple applications, which depend on many different data sources. This type of relationship is known as a many-to-many relationship. Figure 5-6 illustrates the simple relationships of these items.



5-6 Relationship Model Between Users, Applications, & Data

2. The next step in developing a model is to accurately define the applications required to meet the needs of the user by completing a user specific needs analysis. This needs analysis will identify the routine user needs, the requirements for standard products and upward reporting (AR-210-20). The following section identifies typical applications and the primary user defined during a needs analysis.

GROUNDS MAINTENANCE

Show areas receiving service with defined attributes. Calculate and display acreage.

- Mowing (weekly, biweekly, monthly, annually)
- Planter bed maintenance
- Fertilization
- Herbicide
- Perimeter fence herbicide
- Fire ant control
- Plant growth regulators
- Other special test areas
- Areas requiring advance notice and coordination for access
- Proposed management areas
- Frequency and schedule for each attribute as applicable

UTILITY DISTRIBUTION SECTION

Show the depth/height/location of a user defined utility at a user defined point.

- Site map
- Utilities map
- Building site map

ENVIRONMENTAL MANAGEMENT DIVISION

Show the following in a user defined area.

- Site maps
- Prehistoric Indian sites
- Historic period sites
- Buildings, structures, or facilities over 50 years old
- Cemeteries

Figure 5-7 identifies the applications after input to the model.

USER APPLICATIONS

USER_ID	ORG	APPS NAME	NEEDS ANAL	STD PROD	DEFINITION
DPW_EMD	DPWE - ENVIRON-MENTAL MGMT DIVISION	Water Utility Location Map	Yes	Yes	Operations Branch: Show the depth/height/location of the water distribution system. Show results on general site map (gen_site).
		Historic Building Locations	Yes	No	Historical: Show location of all buildings over 50 years old.
		Cemetery Locations	Yes	No	Archaeology: Show the locations of cemeteries in a user defined area. Show results on general site map (gen_site).
		General Site Map	Yes	Yes	General: Show location of buildings, roads, and railroads. Used primarily for base map for other applications.
DPW_MP	DPWE - MASTER PLANNING	Water Utility Location Map	Yes	Yes	Operations Branch: Show the depth/height/location of the water distribution system. Show results on general site map (gen_site).
		General Site Map	Yes	Yes	General: Show location of buildings, roads, and railroads. Used primarily for base map for other applications.
		Cemetery Locations	Yes	No	Archaeology: Show the locations of cemeteries in a user defined area. Show results on general site map (gen_site).
		Historic Building Locations	Yes	No	Historical: Show location of all buildings over 50 years old

5-7 Applications for Each User

3. After defining the relationship between data elements, data definitions, and data sources for applications, an initial database schema is required. The Tri-Service Spatial Data Standard (TSSDS) provides an excellent framework for this. TSSDS is used initially to identify specific data elements needed for each application. As the applications mature, user specific data elements can be added to the database schema. Additionally, completed applications can become a data source for other applications. The model manages the data sources. Figure 5-8 identifies data elements related to a specific application. Note that one data element is the General Site Map application which is reused as a data source for other applications.

NAME	APPS_ID	TYPE	CODE	FNAME
Cemetery Locations	**en_cemeteries**			
		entity	land-cemeb	cemetery boundary
		entity	land-cemec	cemetery centroid
		entity	land-cemet	cemetery text
		application	gen_site	General Site Map
Historic Building Locations	**en_histbld50**			
		application	gen_site	General Site Map
		attribute	str_structure. construction_date	Table.Attribute
General Site Map	**gen_site**			
		entity	tran-drivb	drive area boundary
		entity	tran-prkgb	parking area boundary
		entity	stru-pbdgb	permanent building boundary
		entity	stru-pbdgl	permanent building label
		entity	tran-rdpcc	primary road centerline
		entity	tran-rdpcl	primary road centerline label
		entity	tran-rrcl	railroad centerline
		entity	tran-rrcll	railroad centerline label
		entity	tran-roadb	road area boundary
		entity	tran-rdscc	secondary road centerline
		entity	tran-rdscl	secondary road centerline label
		entity	stru-sbdgb	semi-permanent building boundary
		attribute	str_structure. building_no	Table.Attribute
		entity	stru-tbdgb	temporary building boundary
		entity	stru-tbdgl	temporary building label
		entity	tran-rdtcc	tertiary road centerline
		entity	tran-rdtcl	tertiary road centerline label
		entity	tran-drupb	unpaved drive area boundary
		entity	tran-rdupb	unpaved road area boundary

5-8 Application Data (Data Required for Each Application)

4. The next step in developing a model is to identify data users. This single step is critical when determining potential resource partners (eg. cost sharing). Figure 5-9 identifies the users who either directly (primary user) or indirectly use a particular data element. The model can track data element priority for each user. The result is that those users who consider a particular data element critical should share in the cost of acquiring and maintaining that data.

FNAME	TYPE	CODE	ORG	NAME	PRIMARY
booster station [wat]	**entity**	**watr-bssta**	DPWE - ENVIRONMENTAL MANAGEMENT DIVISION		No
			DPWE - ENGINEERING DIVISION		No
			DPWE - MAINTENANCE DIVISION	GENE GASKINS	No
			DPWE - MASTER PLANNING	BECKI BEW	No
			DPWE - REAL PROPERTY	DONNIE DOUGLAS	No
			DPWE - UTILITY DISTRIBUTION SECTION	GENE GASKINS	Yes
			DPWE - WATER PLANT		No
			DPWE - WASTEWATER PLANT	LYNN VAUGHAN	No
building service [wat]	**entity**	**watr-bldgs**	DPWE - ENVIRONMENTAL MANAGEMENT DIVISION		No
			DPWE - ENGINEERING DIVISION		No
			DPWE - MAINTENANCE DIVISION	GENE GASKINS	No
			DPWE - MASTER PLANNING	BECKI BEW	No
			DPWE - REAL PROPERTY	DONNIE DOUGLAS	No
			DPWE - UTILITY DISTRIBUTION SECTION	GENE GASKINS	Yes
			DPWE - WATER PLANT		No

5-9 Data Users

5. After populating the application-data-user model, the importance of identifying and defining these relationships becomes obvious. Since data is the most expensive part of any information system, the model allows the user to prioritize the data collection, which will produce the greatest return on investment and benefit the greatest number of users. Figure 5-10 identifies data elements listed in priority of greatest need first.

FNAME	TYPE	CODE	OCCURRENCE
drive area boundary	entity	tran-drivb	27
parking area boundary	entity	tran-prkgb	27
permanent building boundary	entity	stru-pbdgb	27
permanent building label	entity	stru-pbdgl	27
primary road centerline	entity	tran-rdpcc	27
primary road centerline label	entity	tran-rdpcl	27
railroad centerline	entity	tran-rrcl	27
railroad centerline label	entity	tran-rrcll	27
road area boundary	entity	tran-roadb	27
secondary road centerline	entity	tran-rdscc	27
secondary road centerline label	entity	tran-rdscl	27
semi-permanent building boundary	entity	stru-sbdgb	27
Table.Attribute	attribute	str_structure.building_no	27
temporary building boundary	entity	stru-tbdgb	27
temporary building label	entity	stru-tbdgl	27
tertiary road centerline	entity	tran-rdtcc	27
tertiary road centerline label	entity	tran-rdtcl	27
unpaved drive area boundary	entity	tran-drupb	27
unpaved road area boundary	entity	tran-rdupb	27
booster station [wat]	entity	watr-bssta	8
building service [wat]	entity	watr-bldgs	8
building service [wat] label	entity	watr-bldgl	8
hydrant	entity	watr-hydrn	8
main [wat]	entity	watr-main	8
main [wat] label	entity	watr-mainl	8
main valve [wat]	entity	watr-mvalv	8
manhole [wat]	entity	watr-mnhle	8
tank - reservoir [wat] boundary	entity	watr-tankb	8
tank - reservoir [wat] label	entity	watr-tankl	8
valve pit [wat]	entity	watr-vpit	8
water well	entity	watr-well	8
cemetery boundary	entity	land-cemeb	5
cemetery centroid	entity	land-cemec	5
cemetery text	entity	land-cemet	5
Table.Attribute	attribute	str_structure.construction_date	4

5-10 Data Priority (Based on Occurrence)

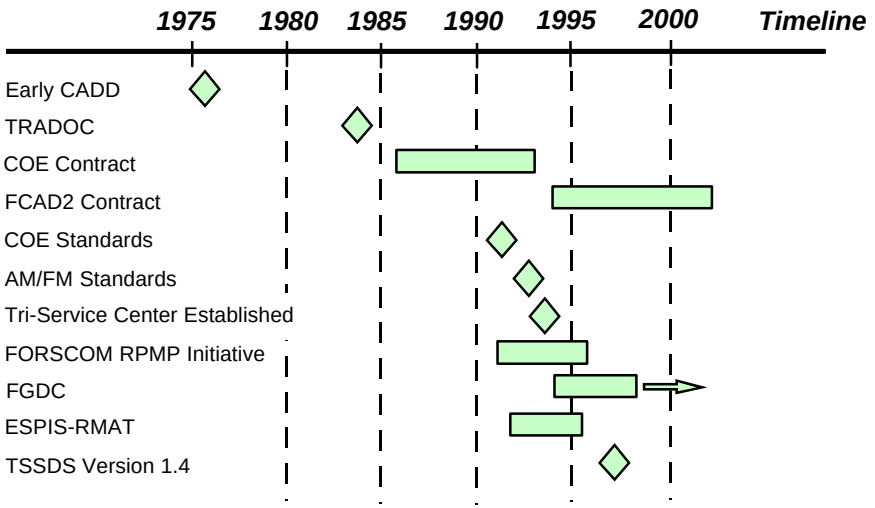
6. Finally, limited resources are forcing users to get as much as possible for each dollar spent. The model provides a tool which, when used during the design and maintenance of a GIS, can assure an efficient information system. It helps to answer the following critical questions:

"Why do I need a GIS (applications)?"
"What is needed for a GIS to work (data)?"
"What can I do first and get the most benefit (data priority)?"
"Who will benefit from a GIS (users)? and
"How can I pay for the GIS (resource partnering)?"

With the Data-Application-Data model we build by design - otherwise we just build!

D. THE ROLE OF AN ARMY GD&S TECHNICAL TEAM

Currently there is no agency or group that is responsible for coordinating the many GD&S efforts within the Army. There is no source that the installation staff can call to gain technical assistance and/or knowledge of other Army efforts. The Assistant Chief of Staff Installation Management (ACSIM) often sets the policies and has the vision of where the Army needs to go, but lacks the knowledge or technical background to implement the vision. An example of this is the Real Property Management Tool (RMAT) effort. The U.S. Army Corps of Engineers Center for Public Works has the mission to manage the task, but no manpower. The Major Army Commands (MACOMs) have attempted to develop a MACOM approach (TRADOC in the mid to late 1980s (Reference item "I") and FORSCOM in the early 1990s (Reference item "J")) but were unable to manage it to completion.



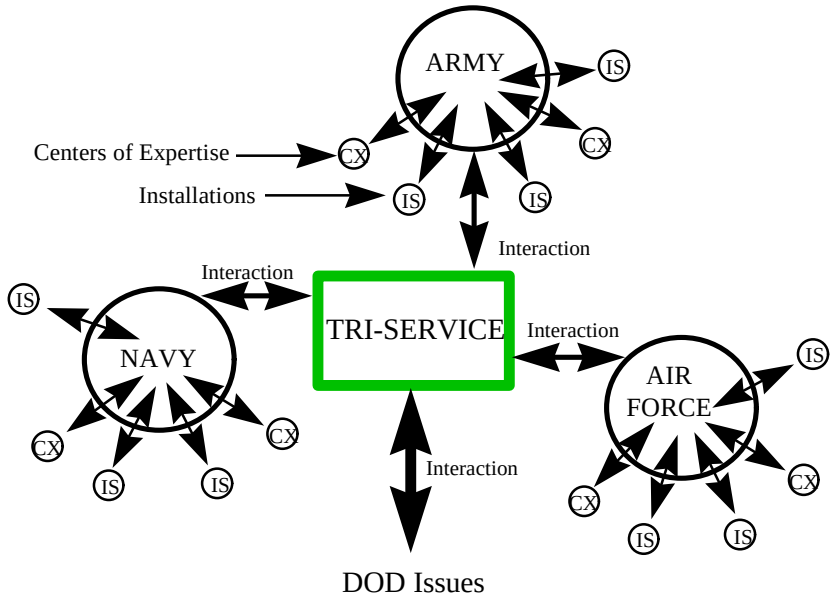
5-11 Timeline of Army GD&S Efforts

The Corps of Engineers is where the majority of the technical GD&S expertise exists within the Army. The Corps is limited in its ability to provide technical expertise because of territorial limitations and the lack of a corporate method for installations to access specific GD&S expertise in the Corps. The Tri-Service CADD/GIS Technology Center is not meeting this need either. The Center operates on a project by project basis and only when all three services benefit. There is no indication of a desire, funding, or manpower to assume a "clearinghouse" and technical assistance role directly to Army installations.

Because of the existing conditions mentioned above, Team GD&S recommends that the Army establish a GD&S technical team that would be a resource for the installation staff for GD&S issues. Such a team would work across multiple organizations and functional areas within the Army to become the source that installation staff would call to gain direct assistance or information. The Team would be a facilitator for the development of partnerships and co-resourcing efforts between agencies so the installations could access the experts they

need. Their role would also be as a liaison between the installation staff and headquarters. The creation of an Army Technical Team would enhance the Tri-Service Center's ability to accomplish their mission by providing access to a technical group that would know the who, how and why of GD&S issues in the Army. The Army team could also be called upon to interface with similar Navy and Air Force technical user groups (refer to Figure 5-12).

Team members should include technical GD&S users from Army organizations (installations, districts, labs) who have demonstrated their GD&S expertise in the past. A team member's or organization's candor and willingness to work together for the collective benefit of the Army is as important as their technical skills. Team members should be able to serve on the team from their location (telecommute) using today's technology. There should be "mentors" from the funding agencies to assist the Team's efforts, but the focus and direction should be set by the technical field level employee.



Each Service Could have a "User Driven" Funded Technical Team

5-12 GD&S Technical Team

Organization and establishment of such a team could be accomplished in a variety of ways. Team GD&S's vision is that each member would serve on the team for two to three years with some members rotating off and new ones added each year. Membership of the team should be no more than five to eight people. Funding for the team should be "co-resourced" annually by multiple organizations (ACSIM, HQs COE, CPW, MACOMs). The Tri-Service CADD/GIS Center could contribute if they supported similar teams in the other services. One or two chairpersons would be funded for a five year tour of duty. Team members' organizations would receive funding for a percentage of their annual salaries and TDY expenses for their two year service periods.

Team GD&S discussed the following possible missions for a technical team:

1) A technical clearinghouse for the Army - Be knowledgeable of and monitor GD&S initiatives underway within the Army.

2) "First line" representation of Army GD&S users to higher organizations (Department of the Army, MACOM's etc.) - The team would interface with the Public Works Business Practices Committees (BPCs). This would, in part, be an effort that would help close the gap between the GD&S user community and Headquarters' requirements. The Team would be the Army's resource for "what is happening" with GD&S efforts and initiatives in the Army. This approach would directly support an objective under Goal 5 in "Installations: A Strategy for the 21st Century" ("Realign authority and responsibility with the objective of empowering decision making at the lowest activity level").

3) "First line" representation of Army GD&S users to the Tri-Service CADD/GIS Center - The Team would be the Center's resource for "what is happening" with GD&S efforts and initiatives in the Army.

4) Facilitator for the development of co-resourcing opportunities between Army organizations - The Team would assist installations in developing a qualified technical team to help them execute their efforts. The team would be responsible for knowing the who, what, and where at the Districts, Labs, and installations relative to personnel who have specific GD&S skills or expertise. This "pool of government expertise" could be tapped by installation staff for participation and/or consultation on issues or projects. Knowing the private contractor's GD&S skills would also be the team's responsibility.

The Team would be responsible for knowing, or seeking out, other organizations (installations, HQs proponents, MACOMs other services) that have an interest and/or investment in GD&S applications. This would include knowing organizations that have similar GD&S requirements. If efforts were perceived to be similar, the Team's responsibility would be to research and determine the possibility of the efforts working together or building upon each other's efforts. This approach would reduce the chances of "reinventing the wheel".

5) Facilitator for the dissemination of knowledge about private sector GD&S contractors - The Team would keep a register of all contracts available for development of GD&S applications to facilitate easy identification and to help make them available as a resource to the Army community.

6) Implementation Assistance - The Team would be on call at no expense (co-resourced from multiple HQs FOAs) to the installations for briefings and investigations prior to the implementation of GD&S technology and for other GD&S issues if requested by the installations. In other words, the Team would be a technical resource for the installations.

7) Identify and facilitate the implementation of root technology components, issues and guidelines - The Team would assist in the identification and implementation of root technology components, issues and guidelines for the Army and Army initiatives. This task would include working as a filter between technology developments (private sector) and the field. Assistance would include the identification of beta sites for the Army and concurrence of development for enhancements to the root technology tool box (hardware, software etc). The Team would work with the Government and the private sector to advance technology and applications for the Army's mission.

8) Technology Transfer - The team would be responsible for identifying and transferring technical accomplishments (products, processes, standards, lessons learned etc.) across multiple Army organizations. They would also be responsible for interfacing and transferring technical information with the Tri-Service community.

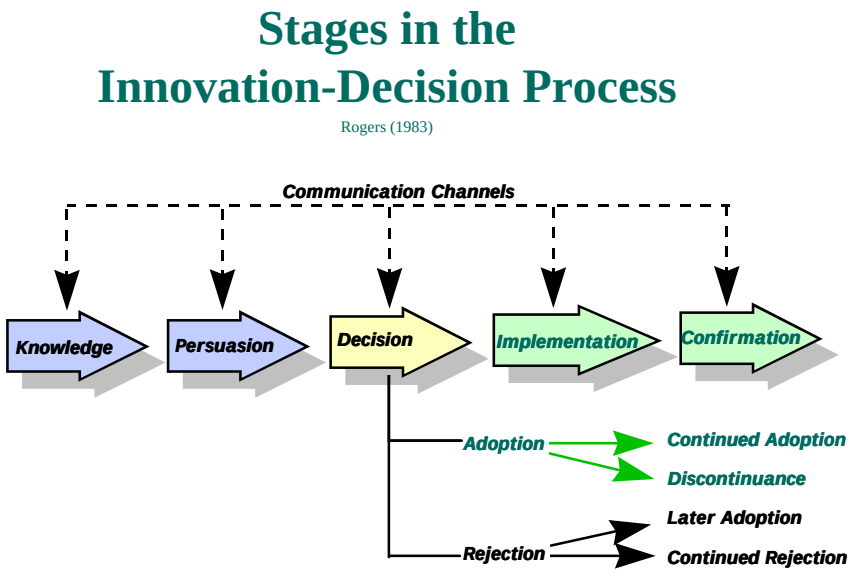
9) Review and Benchmarking -The Team would be in a position to review or evaluate Army initiatives relative to their "value added" possibilities for the Army as a whole and adherence to any corporate approach that the Army may have. This could include both Army initiatives and private sector accomplishments including software and hardware advancements.

6) MANAGEMENT SUPPORT

Introducing a new technology into an organization requires that the organization adopt new methods for decision-making. Organizations typically resist change and they react very slowly and reluctantly to pressure for change. New technology should lead to systems which improve the quality of the work performed. In many cases, this also means that jobs can be done which were previously impossible or impractical. These are the desired, though not always achievable, effects which need not cause resistance within an organization. For GD&S, this means that the availability, quality, and timeliness of spatial information for decision making should be improved compared to the manually produced information. Implementation success and derived benefits will be determined by an organization's willingness to adapt the new technology into their daily decision making processes.

Management support is the main principle that determines the characteristics and eventual acceptance of the technology within an organization. Management support represents the required roles and responsibilities of multiple levels of management support that are necessary to successfully implement GD&S technology. The process of adopting the technology must occur at each level of management within an organization (see Figure 6-1). The technology will only be adopted within an organization to the management level that supports it. **Management support is the most important principal that determines the success of GD&S.**

Installations often rely on one or two key staff to champion and implement GD&S. The resulting GD&S implementation then becomes focused on a specific functional area, in some cases specific individuals, and is not broad enough to serve the entire installation. With appropriate management support, the GD&S implemented as a corporate solution (for multiple departments) will produce short and long term paybacks that benefit multiple functional areas (Real Property Master Planning, Range and Training, Engineering, and Environmental).



6-1 Stages in the Innovation-Decision Process

The Department of the Army must provide management support and allocate appropriate resources for the required planning, preparation, development, implementation and maintenance of Geospatial Data and System platforms. Without this support, the benefits (paybacks) that are possible with Geospatial Data and System technology will not be achieved.

The Army must implement a *Corporate Management Strategy* that enables installations to obtain Geospatial Data and System resources, thereby profiting from lessons learned and solutions tested by those who have already succeeded. The Army cannot afford for every installation to implement unique systems and to discover implementation constraints and opportunities independently. The Army must pool its GD&S resources and solutions into a *Corporate Management Strategy* that ultimately makes GD&S technology more profitable, manageable and easier to implement.

A. GOALS

1. **Obtain** active **management support for** the **implementation of GD&S** technology **at all levels** (functional levels within an installation, Headquarters, Department of the Army, Major Army Commands (MACOMs)).

2. **Identify** and **demonstrate to management** the **benefits** and **r**eturn **o**n **i**nvestment that GD&S technology can produce.

3. Develop strategies for evaluating organizational GD&S outcomes (Army-wide and at the organizational level).

4. Develop an awareness within senior management of anticipated real costs and benefits.

B. OBJECTIVES

1. Implement an **education program for** various levels of **management** on the benefits and risks of implementing GD&S technology into Army business processes.

2. Develop an **analysis method for evaluating and tracking** (a management tool) **the "6 Key GD&S Principles"** of an organization **relative to** their **opportunities and constraints**. Such an analysis method would become the "yard stick" by which an organization's status and progress could be measured.

3. **Develop "success stories"** in functional areas **where management support does not exist**. Some organizations will require proof that the technology will benefit their business processes and mission.

4. Develop a management/casual user Geospatial Data System **graphical user interface**.

5. Seek third-party evaluations to provide a neutral, objective assessment.

C. EXISTING CONDITIONS

There are several classic examples of the influence of management support on the success of GD&S initiatives. For discussion purposes, the level of management support will be defined as follows: Local management - a functional area of an installation; Middle management - management of multiple functional areas; Upper management - executive level management, typically the "green suit" level; Senior management - outside the installation, MACOMs and at the Department of the Army, Headquarters level. One of the following scenarios usually occurs at the installation level:

1. Localized Support - GD&S success stories have most often been championed by an individual(s) or a specific activity at an installation. Typically, someone in the mid to upper level management has a vision and an entrepreneurial attitude toward their business processes and mission. This management view, with one or two technical staff who operate the system, will often form the nucleus of a GD&S initiative. The management participant will acquire the funds via traditional funding mechanisms and the technical staff will produce the results.

Advantages

§ If the management and technical expertise can sustain a working relationship long enough, applications are fielded and expertise is developed.

§ A successful initiative within one organization on an installation can become the start of a corporate approach for the technology across multiple activities on the installation.

§ Localized benefits are realized for a specific office or business process.

Disadvantages

§ If one of the proponents (manager or technical person) leaves the organization, the effort dies.

§ Funding options are limited because of the narrow focus (ie; for master planning or environmental) of the GD&S application.

§ Upper management will place road blocks in the way of the success of a GD&S effort because of personal or organizational agendas.

§ There is a short period of time (window of opportunity) to achieve success. Often the effort is downsized to achieve a success.

§ Technical personnel are not rewarded for their GD&S knowledge and leave for higher grades or the private sector.

2. Senior & Upper Management Support without Local Support - In this example, senior or upper management place requirements on the middle and local management to implement the technology.

Advantages

§ The possible advantage is that someone at the installation level will seize the opportunity to make something smart happen with the technology.

Disadvantages

§ Middle and local management are not given the resources (funds and personnel) to effectively implement the technology.

§ The technology is often implemented as another upward reporting requirement and as an extra duty placed on the installation staff.

§ The level of resources (funds and personnel) required for sustaining the technology are not understood by the senior management.

3. Verbal Support Only - In this example, one of the levels of management will praise the advantages of using the technology but that is as far as the support goes. Management gives “lip service” to the support of the technology and quickly supports any success stories that evolve from their installation. Funding for the GD&S technology and associated job duties is always "other duties as assigned". GD&S technology is not a management priority and is not funded. Often, the working level staff will develop a success story in spite of the lack of management support.

Advantages

§ Sometimes when these "closet" success stories are revealed, management will realize the opportunities/value and begin to program funds and support the technology.

§ Often this is the only way the technology can be implemented because management has the "show me attitude". A success will go a long way toward demonstrating the value of the technology.

Disadvantages

§ The GD&S technology is never elevated to the level of importance required to effectively acquire resources.

§ If a success does not emerge from a localized implementation effort, the staff is severely chastised for attempting the effort, even though management did nothing to support their staff.

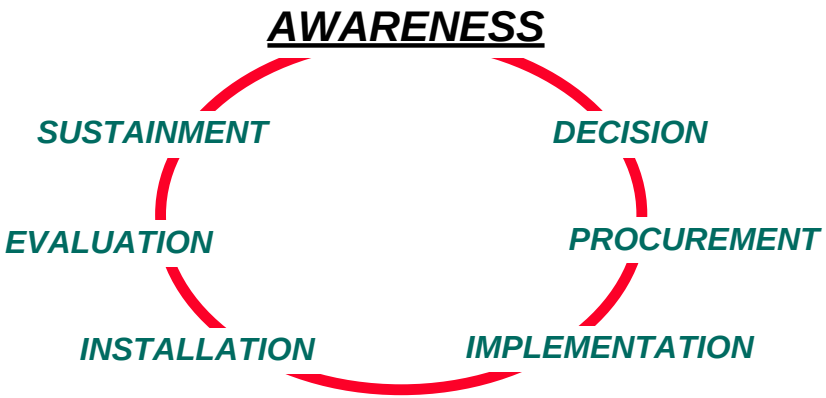
§ The operation and sustainment of the GD&S technology is given a low priority (other duties as assigned). Therefore, the appropriate level of in-house technical expertise can never be achieved.

4. Apathetic Attitude - This is the worst management scenario and is reflective of the attitude that technology is more of a problem than a helpful tool. If management has this attitude, there are no advantages and management acts as a road block to any beneficial initiatives that may result from the technology. In this example, management does not

understand the technology and has the attitude that "we have never done it that way, therefore why should we start now".

D. CONCLUSIONS

Management support, or lack thereof, within a military installation exists throughout the levels of management and to varying degrees. An understanding of where the support does and does not exist is critical to a successful GD&S effort. The ideal situation is to have management support from the top to the bottom, but this is a rarity. Management must become aware of the dimensions of the adoption of GD&S.



6-2 Dimensions of GD&S Adoption in the Tri-Services

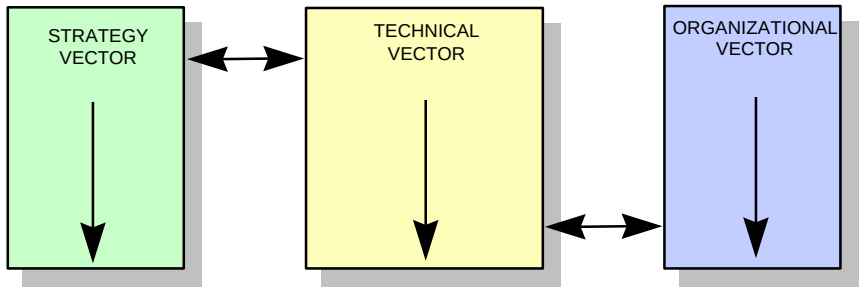
Management is often focused on the end product and does not realize the constraints that users must address to implement GD&S technology. Marketing literature and demonstrations often cause management to assume that the technology can be purchased off-the-shelf, plugged in, and instantly utilized with little or no planning, training or sustainment costs. Management and Garrison Commanders should be educated about issues associated with the proper level of management support necessary for an implementation.

When management support (at any level) and resources can be secured to produce a benefit, Team GD&S recommends that an installation activity begin an implementation effort. The scope of the effort is not as important as getting started. If an installation waits for direction from their higher commands or new technology, they may be waiting for a while. Knowing where the management proponents are located in an organization will be critical to the success of any GD&S effort. Implementation should be an evolutionary process during which managers and users have an opportunity to adapt to and understand the benefits that GD&S tools can provide.

7) IMPLEMENTATION PLANNING

Implementation Planning represents the preparatory planning tasks that are required to successfully install and operate GD&S technology within an organization. The words "implementation" and "sustainment" are used interchangeably in this document. A sustainment plan is a guide for how the technology will be supported and migrated to other applications or activities on the installation after initial implementation has occurred. An implementation or sustainment "plan" is a dynamic tool that documents the process and is used during implementation as a road map for achieving the goals and objectives of an effort and afterwards for evaluation and as goals change. The ultimate goal of any implementation effort should be for the organization(s) to adopt the technology as a tool to assist them in the performance of their mission. Adoption refers to an organization that has implemented the technology into their social and institutional framework as well as the technical aspects.

Most implementation planning efforts have focused on the technical aspects of implementing the technology (hardware, software and applications). There are two other vectors that are often overlooked, the need for the technology to be a part of an organization's overall operational strategy and the development of an organizational/ management framework that will adopt the use of the technology into their business processes. The three vectors should be developed together.



7-1 Implementation Planning Vectors

A recommended detailed breakdown of the implementation process is represented in Figure 7-2 on the following page. A brief description of the major phases of the technical vector of the implementation planning process are as follows:

- A perceived need for the technology -

1) A Site Survey - This is an overview of an organization(s) needs and determines whether the organization can benefit from the implementation of the technology.

- If the result of the survey is yes, then -

2) Do they have a strategic need to meet a mission requirement?

3) Can they develop an organizational/management framework to support it?

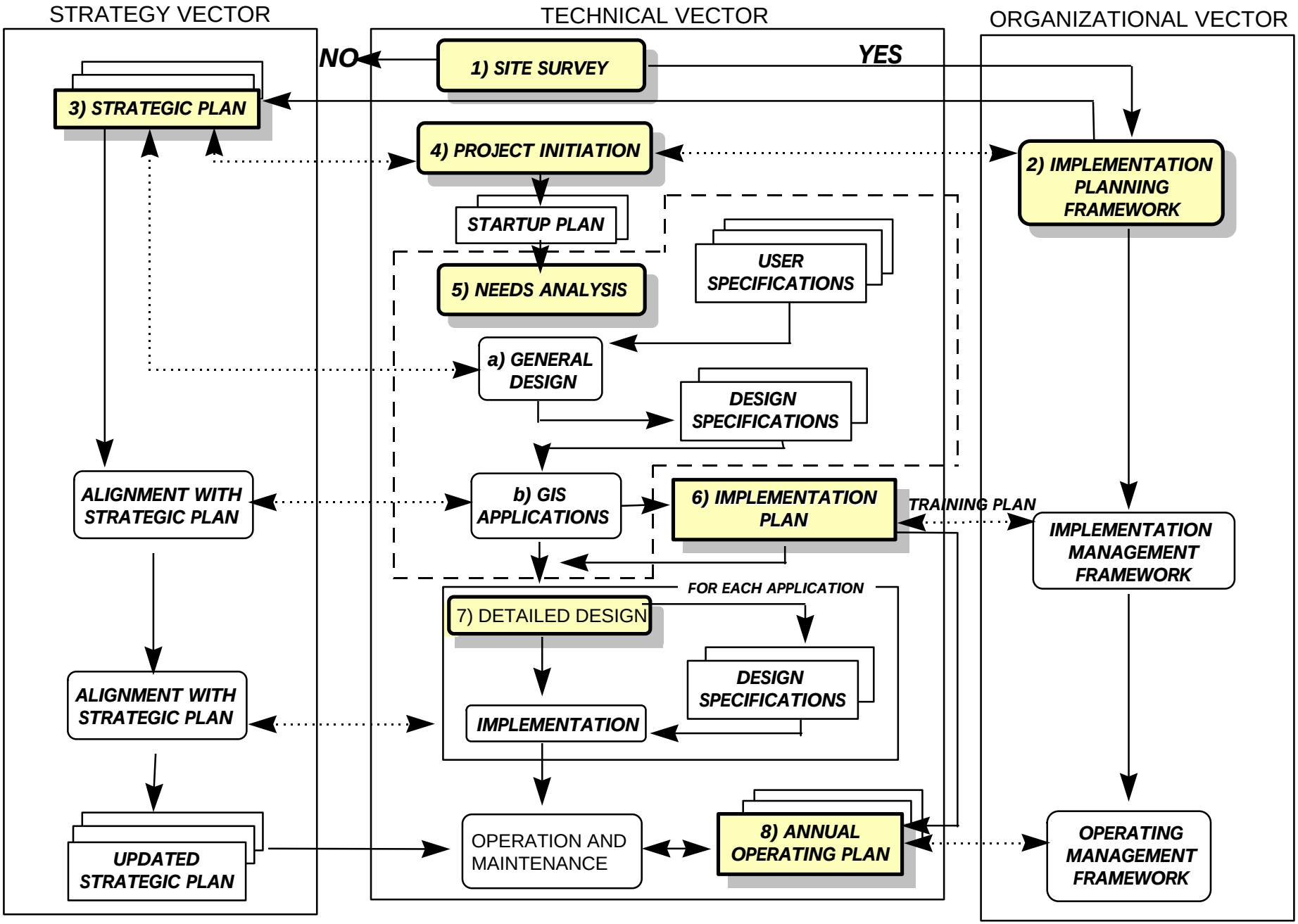
- If yes, then -

4) An implementation project is initiated.

5) Needs Analysis - A detailed needs analysis is conducted to determine ways that the organization(s) can benefit from the technology. Typically there should be two levels of analysis: one to determine all the possible applications for the technology; and a second to determine which applications would produce the most benefits to the organization based on available resources. During the second level (feasibility stage) the priority applications would be evaluated based on the benefits they could provide the organization.

6) Implementation Plan - A "plan" would be drafted to document the processes to date and a plan for developing the application(s) for the organization.

7) Detailed Design - For each application a detailed design would be drafted and executed.



7-2 Implementation Planning Process

8) Operation and Maintenance - The applications developed would have to be supported by the organization's operation and maintenance plan and funded annually to sustain the technology investment within the organization.

All of the steps of the technical vector should be reviewed throughout the technical process for adherence to the other two vectors (organizational strategy and the organizational/management framework) of the organization.

An important aspect of the implementation planning process is the requirement for management and users to work together to define their roles, responsibilities and expectations. During each phase, the products are reviewed by everyone and the expectations become focused and apparent. This is important because the technology is often oversold and expectations are set high without consideration of the six key principles.

The most successful approach is to establish short term goals and a multi-year (phased) plan that contains incremental solutions every few months. Too many installations have looked for longer term paybacks and have missed opportunities to achieve an incremental payback by implementing solutions that automate some of the critical daily work tasks. Short term results reduce the time necessary to achieve a payback and free resources to work on solutions over a period of time. Team GD&S identified a slogan that describes the incremental implementation approach;

"Start small, think big and someday get it all"
versus
"Think big, become small and get nothing done at all"

A. GOALS

1. Identify and publicize the benefits of developing and maintaining an Implementation Plan.

2. Streamline the GD&S implementation planning process.

3. Establish an umbrella implementation/sustainment plan approach that builds up (tiers) from the installation's plan to the subcommands, MACOMs, and the Department of the Army.

4. Develop and maintain an installation level GD&S implementation/ sustainment plan for all installations.

B. OBJECTIVES

1. Implement a management framework to avoid GD&S resource redundancies within an organization or installation.

2. Document and publish case studies that demonstrate the cost savings that result from following an implementation or sustainment plan.

3. Develop guidelines/tools (decision matrix), procedures and templates (forms or wizards) for streamlining the implementation planning process.

4. Present the umbrella approach (after the implementation procedures are streamlined) to a MACOM to gain a proponent and to prototype the concept at several locations.

5. Apply an incremental implementation approach/technique at several military installations.

6. Provide measurable objectives for GD&S implementation efforts.

7. Develop an awareness and focus on the non-technical issues related to implementation of the technology.

8. Establish periodic senior management progress briefings during implementation.

9. Involve the end-users throughout the implementation process.

C. EXISTING CONDITIONS

The process of implementing GD&S technology by following a "plan" has produced mixed results. The majority of the technical knowledge that exists at installations was implemented by following some form of a plan. The examples of implementation efforts using a plan range from using documented plans to efforts that intuitively followed a process without any documentation. In recent years, efforts have been undertaken to define the "boiler plate" implementation process or plan (Tri-Services Implementation Guide). The following are examples of efforts related to implementation planning.

1. Creation and Adherence to a Documented Plan - There have been a few examples of installations that developed a formal plan prior to implementing GD&S technology. Aberdeen Proving Ground (APG) developed a plan prior to initiating an implementation effort. This plan contributed to their success because it kept them from trying one approach after another. It enabled them to identify up-front, realistic milestones and expectations, and establish a roadmap for the desired accomplishments. It also served as a tool to identify processes that produced the most benefit from application of the technology.

Advantages

§ Objectives, milestones, costs, and responsibilities are documented in a plan up front, not months after the initiative has started.

§ A plan serves as the "rudder" for the effort. If the initiative begins to change direction, the plan provides a point of reference from which informed decisions are made during the process.

§ A plan serves as a helpful tool for technical staff to present the issues (costs, time, products etc.) to management.

§ A plan should be dynamic and updated throughout the process, identifying any changes in the goals or objectives of an effort.

§ An implementation plan serves as a historic document. The process of implementing the technology usually occurs over several years. The plan serves as documentation of the process.

Disadvantages

§ Development of an implementation plan will increase the front-end cost of the effort.

§ Development of an implementation plan will increase the initial time required to implement the technology.

§ Often "plans" are completed and never used again.

2. A Plan But No Execution - In this example the installation has completed the process of developing a plan but never took the next step to execute the plan. The implementation plan may have determined that it was not beneficial to proceed to the execution phase. There are many reasons for not executing a plan. The most common reasons are the lack of funds, or the implementation plan was really a marketing plan.

In some cases, implementation plans have been used as marketing plans of the great and wonderful things the installation may want to do with the technology. The purpose of the plan is to acquire funds. A contractor will often develop a marketing effort for the installation and include their biases toward the technology or a specific system. If funds do not become available, the implementation effort dies. The funds spent on the plan may have been better spent to develop a small successful project. The marketing plan approach may have been worth the effort if it assists in acquiring funds or gaining organizational support for the technology.

Advantages

§ An implementation plan will enable an installation to move quickly into the execution phase if funds become available.

§ If the implementation planning effort is used as a marketing plan (what the installation wants to do) it may be of benefit to the installation as a tool to acquire funds or gain management support for the technology.

3. Minimal Plan - In this example the implementation team does not develop a "formal" plan but does take the time to develop a tool similar to a plan. A minimal plan may take the form of a flowchart or an action plan.

In this example, the "plan" is followed but there is no documentation of the effort. The plan usually identifies the technical steps that are required to produce a specific product.

Advantages

§ A minimal plan is better than no plan.

§ Successes have been produced with this approach.

§ This approach can be helpful for setting priorities and serve as a benchmark for progress.

Disadvantages

§ This approach does not address all of the factors involved in an implementation process (management/organization issues, costs, benefits, hardware, and software). Many critical issues can be overlooked and will cause problems later in the process.

§ This approach is understood and followed by the implementation's technical team but is of little value to management and people outside of the team.

§ No historical documentation of the process.

4. No Plan - This example typifies a common occurrence and is probably the worst scenario with the least chance for success. The implementation effort begins without addressing any of the critical issues. The implementation team may wander through a series of tasks, never realizing the full potential of the technology. The expectations and goals become diluted as they proceed through the implementation because of a lack of planning and understanding of the issues, processes and products.

Advantages

§ The only advantage in this example is that the installation recognizes the need to implement the technology. A benefit may be realized if something useful is produced during the effort.

Disadvantages

§ There is no historical data to help others benefit if the effort is successful.

§ This method usually produces a subpar product and effort.

§ An effort undertaken without proper planning will more often hinder the chances of a successful implementation than create a success. A failure can block future opportunities to implement the technology. If management support exists prior to the effort, a failure will probably eliminate that support.

5. The Only Need Is Hardware & Software - In this example, the implementation team is only interested in purchasing hardware and software (HW/SW). The implementation plan consists of a list of hardware and software that users want to purchase. The perception is that having the HW/SW is more important than all of the other issues (management/organizational support and strategies). The Army's funding mechanisms foster this concept because users receive funds for a particular task (ie. automate the master plan) and realize that if they do not buy all of the HW/SW immediately, they may not have a second

chance (refer to Section 9 Technology Investment). This is an area in which users and management must arrive at a common understanding and work toward a balance between the need for HW/SW and the other issues.

Hardware and software improvements change rapidly. Development of GD&S technical skills is an evolutionary process that takes years. Often, by the time the user has acquired the skill level to utilize the capabilities of the initial hardware and software purchase, the prices and the technology have changed, requiring additional HW/SW. A phased procurement of HW/SW based on the users' near term skill level often maximizes their return on investment for HW/SW. Phasing the procurement over a longer period of time enables the user to allocate funds for other issues critical to the implementation process. It enables procurement of more advanced technology for less money as the technology changes become more affordable.

Advantages

§ The user procures the hardware and software required to run the GD&S applications.

Disadvantages

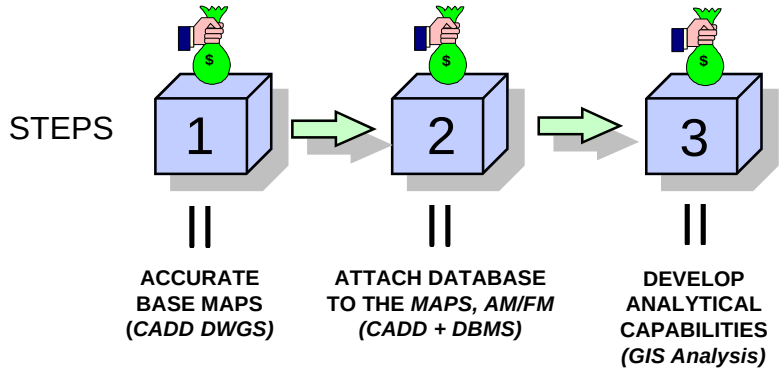
§ The users are not capable of effectively using the hardware and software because they have not budgeted or planned for any of the other issues (organizational, training, management support, application and database development etc.).

§ The procurement of a large amount of hardware and software too early in the implementation process.

§ The procurement of HW/SW may not complement an existing or future corporate framework, which makes it impossible to share data.

D. CONCLUSIONS

Team GD&S recommends an incremental approach to the implementation planning process. Short term goals, objectives, and products producing benefits throughout the process should be established. As the process moves forward, each phase should be independent of the next. If the implementation process is terminated or not funded in the future, the investment to that point should produce a product or benefit to the organization.



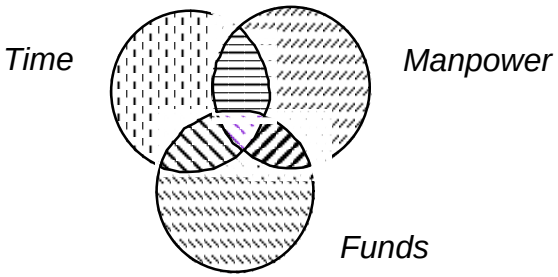
7-3 Incremental Approach to the Implementation Planning Process

Too often, an implementation process occurs over months and years without any identifiable benefits or products produced. Management and users become disgruntled about the value of the effort. One of the most important implementation tasks is to identify a short term product that can be completed within six to nine months. The product can be as simple as automating one work process on a PC that will help the users perform their job.

Often a “pilot project” effort is initiated as a part of the implementation process. A pilot project is used to complete a sample of functionality from of all of the applications that an organization wants to implement. This can be a successful approach, but often no single process or application is completed. Past experience has demonstrated that this can "water down" the functionality of the system and does not always provide a solution for any of the applications or processes. A pilot project effort can be used to achieve a variety of goals. A clear understanding of the goals of a pilot project effort (automated processes, produce specific products, or as a marketing tool) must be understood prior to beginning the effort.

8) RESOURCE ALLOCATION

Resource allocation is the time (the when), manpower (the who), and funds (the how) required to implement and maintain the GD&S technology. There should be a balance of the three resources within an organization.



8-1 Resource Allocation

There is an interdependency that exists between the three resources and collectively they form one of the GD&S key principles. The collective investment of the three resources should match the investment for the development of a database, data acquisition and maintainance of the information (refer to Section 11, Database Development). If this balance is not achieved, the installation will not be in a position to maintain the GD&S data and achieve the desired paybacks. During the implementation planning process, resources that an organization(s) will need are identified.

The opportunities and constraints related to each resource (manpower, funds, and time) should be investigated, planned for and documented. Identification of the time required for a task (the when) is the first step in managing the resources. The duration of GD&S implementation and sustainment tasks must be identified prior to determining the appropriate level of manpower and funding.

The second step is the identification of manpower (the who) that will be performing the tasks (refer to Manpower Section 8A). The third step is the identification of funds (the how) (refer to Section 8B). If one of the resources is lacking, the opportunity for success is greatly diminished. The purpose of the implementation effort should be to acquire the resources prior to expending funds for training, hardware, software or data. The allocation of each of these resources is discussed in the following sections.

A. MANPOWER

Manpower and funds are managed and allocated through two different stovepipes within the resource management chain of the Army. There is no association of manpower and funds until they reach the management level within an organization. Manpower ceilings are not related to funds for specific programs. An installation may have the Full Time Equivalent (FTE) but no funds, or the reverse. Manpower projections are established too far in the future and are subject to political influence. The FTE requirement often does not reflect the current situation.

The Army's approach to management of manpower and funds creates problems within organizations attempting to implement and sustain GD&S technology. Co-resourcing offers an approach to offset the affects of the traditional ways of managing manpower and funds. If an installation or organization has the FTEs and no funds, they should investigate opportunities to partner with organizations that have the funds, or vise versa.

1. Goals

1. **Plan, identify**, and **commit** the **manpower** required **to support** the appropriate level of **GD&S implementation** within the organization(s) (installation, HQs, MACOM, etc.).

2. **Define** the **optimum** amount of **in-house manpower to maintain the GD&S** systems at installations.

3. Establish **career opportunities relative to** a person's level of technical **GD&S expertise**.

4. Establish **incentives to retain GD&S expertise in the Army** (see Section 10 Training/Experience).

5. **Share telecommunication resources** and technical **staff** across organizations.

2. Objectives

1. **Match manpower requirements to** the **tasks** identified **in** the implementation **planning process** for each organization(s).

2. **Acquire manpower** for an installation or specific organization(s) **via a combination of approaches** (in-house staff, Corps Districts, Laboratories, contractors and academia). The approapriate combination will vary from installation to installation.

3. Use a **co-resourcing** approach **across organizational and regional boundaries for** acquiring technical **manpower** as a vehicle for technical transfer and mentoring of GD&S knowledge within the Army.

4. **Acquire** the optimum **GD&S** in-house **expertise at** all **installations**.

5. **Establish** and fund an **Army Geospatial Data System** technology team **to facilitate technology transfer and support Geospatial Data System development and implementations**.

6. A mission purpose should be established for an Army **GD&S** technical **group to assist** in the **management and execution of the co-resourcing of manpower** (within the installation's boundaries and beyond).

7. **Consult with** Army and Tri-Service **peers** before contracting for GD&S services.

8. **Develop** a **management framework** to promote and facilitate the **sharing** of **resources across organizational boundaries** for the benefit of the "total" installation.

3. Existing Conditions

The following are examples of existing conditions related to manpower.

a. No Corporate Approach to Manpower - Team GD&S found that there is typically no attempt to develop a corporate approach for allocation of manpower for GD&S tasks across multiple organizations. Organizations within the same installation often have varied degrees of success in acquiring manpower. Some organizations have the funds and tools (hardware and software) but no staff to manage the systems, others have the staff and no funds or tools, and still others have the staff, tools and funds.

Organizations within an installation often view each other as competitors. This attitude reduces the effectiveness of the management of GD&S manpower for the good of the installation as a whole. Often, GD&S skills can be applied to a variety of applications and missions for several organizations.

Advantages

§ Any GD&S manpower in an organization is an advantage and can become the nucleus of a broad installation approach.

§ If more than one organization has GD&S manpower, there is an opportunity to level the work load if one organization becomes over tasked.

Disadvantages

§ Manpower is not maximized for the overall good of the installation.

§ Opportunities for co-resourcing of manpower are limited.

b. Need for Minimum In-house GD&S Manpower - Knowledgeable in-house staff is critical for managing and maximizing the use of all resources for an organization. Installations should establish a minimum skill level within their in-house manpower. Many installations/ organizations are forced to rely almost exclusively on contract labor for the management of GD&S resources. An emphasis on this approach does not build the required in-house experience. A minimum skill level is required within an organization as a form of checks and balances to the efforts of a contractor.

Advantages

§ Any type of in-house manpower, contractors included, should be procured to meet the demand of the organization.

§ A good method of utilizing funds and meeting manpower requirements is to augment in-house expertise with contractors, particularly at year-end.

§ Some tasks are better for contractors because they can focus more intently on the task. Government personnel have to work with all the peripheral bureaucratic issues that divert their attention from executing a task.

Disadvantages

§ An over reliance on in-house manpower from a contractor makes the government staff too dependent on the contractor in the execution of the organization's mission.

§ The contractor's costs will typically escalate over time.

§ The government's in-house technical knowledge will begin to deteriorate as an increased reliance is placed on the contractor's skills.

c. Downsizing - As downsizing occurs, installations that have been supporting GD&S by way of "other duties as assigned" are the first to feel the effects. The Army must find new ways to partner, communicate lessons learned, and co-resource manpower. The importance of the technology is not adequately realized by management and will be severely impacted, even among organizations that have full time staff for GD&S.

Advantages

§ Downsizing has established a climate to seek other alternatives (co-resourcing) for acquiring manpower that might not otherwise have been pursued.

§ Downsizing will force organizations to look outside of their "box" for solutions.

Disadvantages

§ Increases the difficulty in acquiring manpower.

§ It will, in some cases, prevent installations from maintaining the minimum level of GD&S manpower.

§ Reduced manpower will cause some organizations to draw inward or revert to the old way of doing business to survive.

d. Staff Turnover - The Army has a difficult time keeping GD&S technical staff. Once a person has acquired these skills they command a higher salary in the private sector. Hiring a contractor for GD&S expertise can reduce this impact. If a contractor loses an employee they can quickly replace him, unlike the Army. Often a GD&S system will be developed around a particular individual and when that person leaves the organization the knowledge of the system leaves with them. In this example the person who was the champion of the technology took the task upon themselves to develop their skills.

Advantages

§ Increases the need for standardization of GD&S tools (ie. "root technology") across the Army.

Disadvantages

§ Costs of training personnel.

§ Down time when a person leaves and a replacement employee is hired and learns the business.

§ The "proponent" of the technology leaves and the GD&S capability dies.

4. Conclusions

The Army is getting smaller and the manpower for managing GD&S will be reduced. Implementation of GD&S can help the Army execute its mission in a reduced manpower environment. Military organizations will have to look outside their traditional methods of acquiring manpower to execute their mission. The development of a regional GD&S technical support plan may be an option. With this option the Army would identify the organizations with existing GD&S technical skills (areas of expertise) and develop a plan that would allow installations to access the manpower skills of the organizations.

The Office of Personnel Management (OPM) should recognize GD&S skills in the development of job series. The technology is a tool for many users (see Chapter 10, Training and Experience) with a variety of missions and requirements. Level 3 (System Administrator) & level 4 (file server maintenance) lends itself to developing a critical mass of expertise to share manpower across the installation's organizations and even beyond the installation (Districts, labs, or other installations). Level 2 (CADD/GIS technician) can also be co-resourced. GD&S technology does not necessarily require the addition of FTEs. It does require training of existing staff in a "new way of doing business", a new skill using the technology.

B. FUNDS

The importance of a plan to gain the maximum return on the investment is more important today than ever before because of the reduction of military funding. Traditionally, funding for GD&S is not centrally funded. The Directorate of Information Management (DOIM) is often the only centrally funded organization that receives funds specifically for GD&S. When programmed, DOIM funds are received and are usually directed toward maintaining wide or local area networks and communication lines. The DOIM's funds are rarely used to implement or sustain GD&S applications for the functional users. Funds for specific GD&S applications for use by a functional area are generally acquired from within the functional area.

Acquisition of funds from a single functional area or project promotes the development of "point solutions" and a possessive attitude - "I paid for it, it is my system and my data. The other functional areas can get their own system." To achieve the maximum return on investment with GD&S, a corporate approach to funding is required (funding from multiple organizations or programs). Justification for funding of point solutions for a single functional area or purpose is more difficult. As funds are reduced, co-resourcing of funds becomes a more viable option. The maximum benefits from a GD&S investment can only be achieved when the information can be used by multiple functional areas for multiple purposes.

1. Goals

1. **Build** an **investment strategy for funding** the appropriate level of **GD&S implementation** within the organization(s) (installation, HQs, MACOM, etc.).

2. **Determine** the **costs and benefits** (related to all six principles) **of implementation and sustainment** of the technology.

3. **Increase** the **use and application** of project orders **(multi-year funds) for GD&S** efforts.

2. Objectives

1. **Co-resource program funds across organizational boundaries** (functional areas on an installation or from one installation to the next, HQs, MACOMs, etc.) **for** implementation and sustainment of **GD&S** when it adds value to the customer's product.

2. **Co-resource project funds across organizational boundaries for** implementation and sustainment of **GD&S** when it adds value to the customer's product.

3. **Perform a cost/benefit analysis** of the implementation of the technology at the installation, **prior to investment** (see Appendix F).

4. **Demonstrate, document and promote** the benefits of using project order **(multi-year) funding** for GD&S projects.

5. **"Manage to budget"** - Stay within budget for a tasks and programs. Manage the dollars not the manpower.

6. **Program funds from multiple agencies (ACSIM, HQUSACE, CPW, MACOMs, etc.) to support the GD&S technology group.**

7. Coordinate obligation of available end-of-year monies with implementation/sustainment plan.

3. Existing Conditions

The following sections describe common conditions that exist within the Army.

a. Timing of Receipt of Funds - A balance of funding is difficult to achieve. The lack of funding for GD&S is a common situation with obvious results. The arrival of sizable amounts of funding at the end of the fiscal year requires them to obligated quickly. This situation places an increased emphasis on the need for prior positive planning. An implementation plan identifies specific needs and can be a useful tool for the allocation of funds at year end. Matching the need with the timing and funding is difficult. At times there are no funds. At other times, the funds are available but it is difficult to optimize their use.

Acquisition of multi-year funding is an approach that can stabilize the timing of the receipt and use of funds. Multi-year funds enhance the opportunities to plan and commit funds as the needs arise, compared to a "react mode" of operation. Multi-year funds also enhance an organization's ability to develop in-house expertise within their manpower levels by providing opportunities for employees to obtain training and gain experience.

Co-resourcing of funds is another method of stabilizing funds. If the GD&S is accessed by multiple functional areas, it should be supported by all. This provides multiple opportunities for the acquisition and use of funds throughout the year.

Advantages

§ Acquisition of funds for GD&S is a positive step regardless of the timing.

Disadvantages

§ Difficult to maximize the return on investment.

§ Opportunities for successful implementation or sustainment of the technology is decreased by fluctuating funding.

§ The realization that funds are required to sustain the technology beyond the initial investment is often overlooked when a large sum of money is identified for implementation. Later, it becomes apparent that the funds required for sustainment are not available and the original investment is lost.

§ When a lump sum of funds is acquired an activity will often "over buy" the amount of hardware and software required compared to other GD&S needs (data, training, maintenance, staff etc.).

b. Lack of an Investment Plan - Few installations have developed a plan and adopted a corporate approach for funding of the implementation and sustainment of the technology. There is a variety of reasons why organizations do not develop a plan (lack of understanding of the process, time, funds, parochial biases, etc.). A needs analysis is part of an implementation plan that should identify requirements. These requirements should then be matched with mission requirements, products, programs, and proponents, all of which can be a sources of funding.

Advantages

§ The costs for development of an investment plan are recaptured by benefits gained from implementing the technology.

Disadvantages

§ No documentation or planning for funding of the requirements before funds arrive, causing the organization to operate in a “react” mode to obligate funds.

§ Without an investment plan, opportunities to optimize funds are difficult to identify.

c. The Functional Area With Funds Determines Direction - When a functional area has successfully acquired funds and implemented the technology, they often impose "their way or system" upon others.

Advantages

§ Activities that have acquired the funding for the technology are in a position to provide a service to other directorates.

§ Determination that multiple organizations will be required to operate one platform reduces an organization’s interoperability problems.

Disadvantages

§ Imposing a system or rules upon multiple activities may cause problems because the capabilities of the system and requirements may not match.

§ When more than one organization has acquired the funds for GD&S, a rivalry may be established that does not lend itself to a corporate approach for funding.

d. Lack of Understanding of Funding Requirements - An understanding of the total funding requirement is often lacking. Organizations tend to focus on the obvious issues (hardware, software, or data) and discount the other issues (management support, implementation planning, and training, experience, or knowledge).

Often, organizations acquire funds and fail to recognize the value of balancing the investment across all six of the key principles. The tendancy is to focus only on tangible resources, leaving the other issues (social, management, and organizational) to happenstance.

Advantages

§ Acquisition of HW/SW or data is a requirement and should be acquired when possible.

Disadvantages

§ Focusing on HW/SW and data limits the amount of funds available for other issues such as manpower, training and maintenance. An unbalanced funding level for any one of the six principles can reduce the benefits.

§ When the GD&S technology is not successful, the funds used for acquisition of the HW/SW or data are used to justify their reasons for not implementing the technology.

4. Conclusions

Development of an implementation plan is the most important step that can be taken to maximize the use of funds and offset the irregular timing of the receipt of funds. **Having a plan that identifies the short, mid and long range funding requirements helps to better allocate funds as they are received.**

Short, mid and long range benefits should follow a time sequence for acquisition of funds. All of the benefits of the investment should not be placed in later years. A return on the investment should be realized at identifiable milestones during the process. Opportunities for additional funding will also increase as incremental successes are achieved.

The second most important step is to co-resource funds. With the reduction of funding installations should take efforts to identify overlapping requirements, at a program or project level. When overlapping requirements are identified, a shared investment plan should be adopted. The plan should enable multiple organizations to partner with one another to acquire the funds necessary for GD&S technology. Co-resourcing should be practiced at multiple levels within the Army (within functional areas, across functional areas, between installations and within Army programs at MACOMs and at the Department of the Army).

The reduction in funds places an increased responsibility on organizations to be aware of, and maintain a knowledge of funding mechanisms within the Army, such as the Navy's NAVFAC CAD2 contract and Architect/Engineer (AE) Indefinite Quantities (IDQ) contracts. This will require organizations to look beyond their traditional methods and investigate other possibilities. The opportunities gained by working with a Corps District or other FOAs outside the installation should not be overlooked.

Team GD&S recommends that the Army reduce the restrictions on the use and acquisition of multi-year funding for GD&S efforts. When multiple year funds, such as project orders, have been utilized, a greater return on the dollar invested has been realized. Organizations are able to prudently manage funds to gain the most benefit. Typically, organizations have to obligate large sums of funds quickly, "the react mode". This approach leads to inflated prices, errors in judgement, limits opportunities for developing in-house expertise, limits co-resourcing opportunities and reduces the overall benefits that can be gained.

C. TIME

The time required for installation staff to devote to implementing the technology is often the most difficult to obtain. Even after the staff and funds are acquired, the organization must place a priority on implementation that is equal to the regular duties of the person/organization. Installation staff may attend training, but often find it difficult to apply what they have learned on the job because of the need to perform their traditional duties that do not involve the technology.

1. Goals

1. **Plan** for, **identify**, and **commit** the **time** required to support the appropriate level of GD&S implementation within the organizations (installation, HQ, MACOM, etc.).

2. **Provide intermediate products** and return on investment **during** the **implementation** of the technology.

3. **Reduce** the **time** required **to implement** new technology.

2. Objectives

1. **Determine** the **time** (hours per day, week and year) **required for** the installation staff to **sustain** the GD&S **technology**. Then obtain the

commitment from management to staff accordingly (see Manpower, Objective no. 1 for methods of accomplishment).

2. **Develop** an **awareness** and **commitment to** the amount of **time** required to implement and sustain the technology within the organization(s).

3. Existing Conditions

The following text describes common conditions that exist in the Army.

a. React Mode - The "react mode" of doing business at an installation affects all tasks that the installation staff attempts to perform and GD&S tasks are no exception. The react mode exists when the installation staff move from one crisis to the next, without time to plan and schedule the needed GD&S tasks. Managing GD&S technology is difficult to sustain with a react mode of operation, in part, because tasks are difficult to define within a specific amount of time.

The importance of the GD&S tasks to the traditional duties performed at an installation is often not apparent to management. This relationship is usually not realized until management wants an answer from the system. If the database and graphics have not been maintained, only part of the answer may be available. The time required to update the information is often too great to meet the suspense. Updating the system is included in "other duties as assigned". In other words, if the installation staff has the time, it will get done. Otherwise, it will not happen until the issue becomes important to management. When management can not receive an adequate and timely response from their staff, because the system has not been maintained, the potential exists for management to change their view of the importance of the technology and adjust job duties to accommodate the need.

Advantages

§ The "react mode" of operation can be an advantage if it is the catalyst for successfully elevating the need of maintaining the GD&S data to a higher position within the organization's priorities.

Disadvantages

§ When management can not receive an adequate and timely response from their staff because the system has not been maintained the potential exists for management to revert back to the "old way of doing business" without using the technology.

b. No Planning - Implementation planning often does not receive the attention required. The amount of time to execute specific tasks is identified during the implementation planning process. It is important that the installation staff devote the necessary time to the implementation process and tasks assigned to them. The organization and persons involved must make the time using the technology as important as their regular duties. The traditional response from installation staff is "we do not have time to perform any new duties." This response is often accurate, but should not be used as an excuse. Many organizations never move past identifying and understanding the tasks and the associated time required. If an organization is not committed to devoting the time to perform the implementation and sustainment of the technology, it should not be implemented at all or should be implemented by other organizations.

Advantages

§ none

Disadvantages

§ Without identification of the necessary tasks and time required, which is identified in the planning process, the manpower and funding requirements can not be determined.

c. Lack of Required Training - GD&S technology requires periodic training for the staff to maintain their skills. The requirement for training takes time away from the regular duties of the installation staff. Therefore, management is often reluctant to schedule and fund training. The development of "in-house" expertise is critical and training can lay the foundation to the success of an organization's ability to effectively manage the technology. The level of expertise and the related training will vary from one organization to another within an installation.

Advantages

§ none

Disadvantage

§ If the installation staff does not receive the required training the staff will not be able to use the technology effectively and efficiently.

§ Lack of a program to develop an "in-house" skill level within the organization(s) will severely reduce the position of the government staff to effectively manage projects that have GD&S technology as a component.

d. Too Much Training Too Fast - When GD&S technology is first implemented at an installation, there is a requirement for a large amount of training for multiple staff members. Often, there is a tendency for installation staff to want to train many people, with varying abilities, on all aspects of the technology, in a short time period of time. The staff takes the approach that everyone must be trained immediately, for fear that they may not have the opportunity later. This approach leads to wasted training funds because people need time to apply and master the tasks on the job that they have learned prior to moving to the next skill. In most cases, there is a budget for initial training and it must be procured at the beginning of a project. The scheduling of the classes should be spread over a period of time and matched to the target level of a user's position and their need for a particular skill. Everyone on staff cannot be a CADD or GIS expert.

Advantages

§ Any training is better than none, regardless of how and when it is acquired.

Disadvantages

§ Reduces the effectiveness of training funds and development of in-house expertise.

e. Unrealistic Timeline - Often the amount of time estimated to perform specific tasks is greater than expected. This is often inherent to the nature of a GD&S task if: the staff has never attempted the task; there is a series of hidden tasks after initiation of the first several steps; it has never been done before; or a vendor misrepresents the amount of time required as a tactic to sell more. The definition of the tasks is important relative to time. Tasks such as updating the graphics and database must be presented to management as ongoing tasks that will need to be managed and resourced every year.

Advantages

§ none

Disadvantages

§ When the completion dates for a task slip, it destroys the management support for the technology.

f. Implementation Time Exceeds Technology Development Time - The time required to implement GD&S technology within an Army organization often exceeds the average length of time for development of new technology. GD&S technology improvements change rapidly and do not fit into the traditional Army's mode of operation and business environment.

The Army is slow to change its business processes and when the technology is an integral part the changes it seems to be even slower.

The length of time it takes to develop and field the applications is longer than that of private industries. Army programs that use GD&S technology are often outdated when fielded.

Advantages

§ In recent years, Headquarters, Department of the Army has been pro-active in the development GD&S tools.

§ The Army has an opportunity to influence the technology industry in the private sector for the development of Army applications.

Disadvantages

§ The Army is not able to leverage the development of new technology into ongoing Army programs, even when the new product is a better solution.

4. Conclusions

The amount of time for specific GD&S tasks should be identified during the implementation planning process. There must be a commitment, up front, from the organization(s) to allow their staff the required time to develop the necessary skills. If management will not allow this time away from their traditional duties, unrelated to the technology, the implementation of the technology should be terminated. This requirement for time is particularly important at the beginning of an implementation effort. The end user should be given the time required to be involved in the process of implementing the technology from the beginning. If the end user is not involved from the beginning, the users' 'buy-in" of the technology is hindered and in-house GD&S knowledge is not developed.

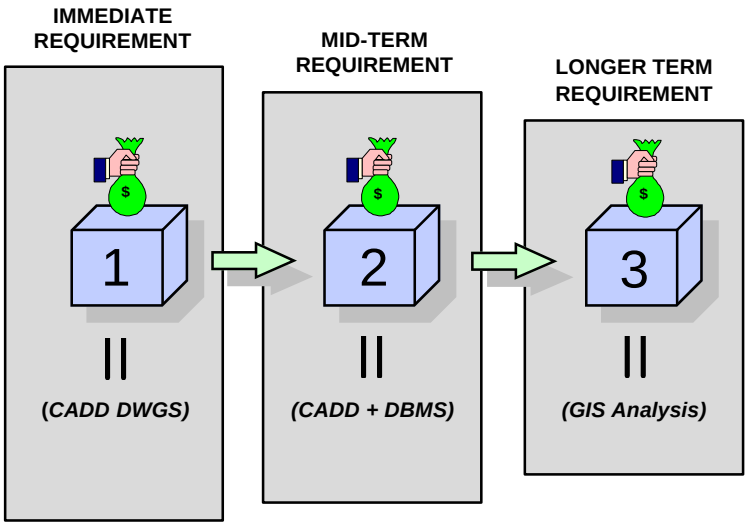
Management must understand that some tasks are on-going and will require a commitment of time by their staff member(s) to maintain and sustain the system. These tasks should be presented to management at the earliest opportunity so the organization can plan for and accommodate the need. If the time needed to maintain the system can not be committed, the effort should be terminated.

Training is critical to the implementation of the technology and must be supported. The beginning of an implementation effort will require the most training time. The frequency of training is also important. A person should have an opportunity to apply their skills on the job prior to advancing to the next level of training. However, once the initial training is completed, there should be scheduled times for additional training opportunities.

Organizations should adopt an incremental implementation plan concept whereby the organization(s) realizes short term benefits from the implementation of the technology. Too often, organizations will plan to reap the benefits two to three years down the road when they consider the implementation effort finished. Organizations should set short term payback goals at various stages of the implementation effort. Implementation of a GD&S system is actually never completed, but reaches a state of maturity from which the organization can begin to realize benefits. If too much time passes after the start of an implementation effort without any tangible benefits to the organization, there is a risk that the effort will die because: technology advancements will surpass the effort (the tools and/or approach will become outdated); the personnel involved will leave the organization; or, enthusiasm and confidence in the effort will deteriorate to the point that the effort is terminated or the initial benefits are never realized.

9) TECHNOLOGY INVESTMENT

Technology investment represents the required hardware and software that an installation must purchase to establish a GD&S platform. There must be a balance between what the installations purchase and what their immediate needs are. Too often installations are forced to buy all they can when funding is available (not knowing if future funding will be stopped), not as they need the technology. As a result, installations are forced to buy technology and have it become outdated before its full capabilities are realized.



9-1 Technology Investment

The most common type of GD&S used within the Army is CADD systems. In the past there were clear distinctions between the various levels of system capabilities (ie; CADD, AM/FM, and GIS). Today, technology has blurred these differences. While there are still differences, Team GD&S refers to them as levels of complexity under the term GD&S. The selection of one type of system over the other is not the issue. **The important question is, "which type of system will meet the requirements of the user or customer's application?"** The initial implemention of the technology should satisfy the user's most frequent and immediate need (see Reference item D), then grow to accomodate more complex requirements.

A. GOALS

1. **Implement** a **root technology** approach **as a corporate solution** for investment in the **technology**.

2. **Increase** the **fidelity, usability and accessibility of data**, via investment in the technology.

3. **Create** an **environment** where the **GD&S users drive the technology**, not where the technology drives the users.

B. OBJECTIVES

1. **Identify a process to define, test and validate** the components of a **"corporate" toolbox** (graphic and database engines, operating systems, user interface tools, etc.) **for** the development of applications and implementation of **root technology**.

2. **Approve and implement a process** (see Objective No. 1) for **sustainment of "root technology"** for the Army.

3. **Develop the criteria and process** for the **investigation and determination of local solutions** (processes, products, etc.) that **support a corporate Army solution.**

4. **Standardize processes** around the common geospatial data to **avoid duplicate development costs.**

5. **Identify, prioritize and fund** the corporate investment needs that enhance the **interoperability of data across** multiple Standard Army Management Information Systems **(STAMISs) and** the existing **installation** level **geospatial data systems**.

6. **Develop a methodology** that **identifies** the **existing installation systems** that will "plug" into an Army corporate approach, **prior to funding any new initiatives** for similar purpose.

7. **Define and apply** the concept of a **"Root Technology"** approach **to** the development of **Army** GD&S **applications**.

8. **Develop a process** by which the Army can **provide leadership to** the **commercial developers** of GD&S technology **for Army programs or applications**.

9. Establish **Army Geospatial Data System leadership** (technical review board or users) **to guide commercial development**.

10. **Solicit input** from **experienced GD&S** technical **personnel** in lieu of making quick procurement decisions.

11. **Investigate procurement options** (outside typical organizational boundaries) for available federal contracts and technologies.

12. **Determine** the GD&S **application first, then procure** the equipment to meet the needs of the application.

13. Encourage **cooperative ties** with the **Directorate of Information Management** (IM) activities.

C. EXISTING CONDITIONS

The fluctuating availability of funds and the cumbersome bureaucratic regulations (Federal Information Procurement (FIP) and FIRMR, etc.) contribute to the following:

1. Hardware & Software Does Not Meet the Need - Installations or organizations often procured more HW/SW than they can become proficient and productive with in a reasonable amount of time. The reverse situation also exists, as users' needs grow, their ability to make timely purchases to meet needs is often restricted because of procurement regulations. GD&S requirements are programmed several years in advance and the users are required to anticipate their needs before they are realized. Technology changes quickly, and the fact that the business processes in the Army are changing rapidly increases the need for the users to have the authority and flexibility to acquire the technology as the needs are identified.

Vendors also influence what hardware and software (HW/SW) is purchased for Army organizations. Often organizations will be presented flashy demonstrations by vendors showing all the advanced capabilities that their HW/SW have. The staff typically does not fully understand the technical issues of the application or the behind the scene requirements (social, organizational, training, sustainment, manpower, etc.), but still believe that they need the HW/SW. The organizations often purchase the vendors' products only to realize that they do not use much of the functionality that was sold to them (ie. they were sold a GIS but really only needed a CADD system). After an organization goes through this several times they accumulate a miriad of hardware and software, of which they only utilize a small percentage. Refer to Figure 9-2 on the following page.

Advantages

§ HW/SW is important and should be procured whenever possible.

§ Planning for HW/SW in future years is good policy.

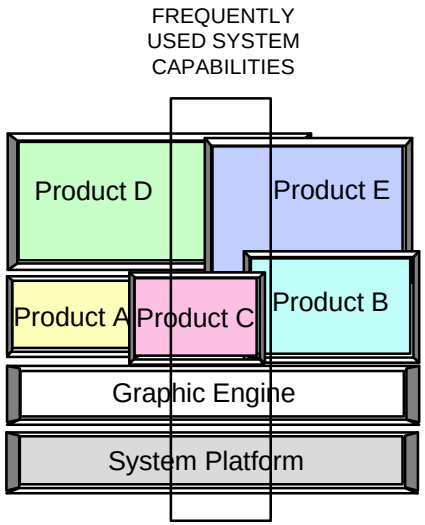
Disadvantages

§ The HW/SW is outdated by the time the need or application is developed.

§ Procurement of HW/SW is often vendor driven which usually leads to buying more HW/SW than is required to meet the need.

§ Cumbersome procurement regulations increase the costs and make procurement of HW/SW difficult.

- The Army cannot afford to piece together multiple layers of Commercial Applications



Army requirements do not always match commercial product capabilities. The Army should not have to modify its workflows to conform to commercial products.

9-2 Army Requirements and Commercial Product Capabilities

2. No Integration of Higher Headquarters (Top-Driven) Programs/Initiatives with Installation Level Initiatives - In recent years there has been a heightened interest in implementation of the technology from higher headquarters (ie. Forces Command (FORSCOM), Assistant Chief of Staff for Installation Management

(ACSIM) and U.S. Army Center for Public Works (CPW), and the Training & Doctorate Command (TRADOC) (see Appendix B, "Background of GD&S in the Army").

This has confused many users and issues, such as which platforms and HW/SW should be used at the installation, and which types of applications the HW/SW should be used for. After users implement a system they are reluctant to change and higher headquarters are not funded to migrate the "grass roots" systems and data to the corporate systems.

Advantages

§ The Department of the Army's Headquarters organizations have recognized the importance of implementing the HW/SW at the installation level for the execution of the installation's mission.

§ Installations can co-resource (top-driven and locally sponsored initiatives) on a local level to gain the needed HW/SW.

Disadvantages

§ Top-driven programs/initiatives do not realize the sustainment requirements that their programs and initiatives (which field HW/SW) place on the dwindling installation resources (social, organizational, time, manpower, & funds).

§ A lack of coordination between headquarters initiatives (DA, MACOMs, Corps of Engineers; Districts Laboratories, etc.) with other headquarters initiatives and the customer confuses the installation staff.

§ The is no interoperability between STAMISs in the Army. If the installation staff used the systems requested by higher headquarters, they would have to learn, maintain and operate multiple systems.

3. Proliferation of Point Solutions - The past decade has produced a miriade of "point solutions" throughout the Army, via local or headquarters initiatives. Collectively this has advanced the use of GD&S technology into a predominant role within the Army's business processes compared to the other services or government agencies. The concern about the "point solutions" is that no

organization in the Army is attempting to identify and transfer the accomplishments or lessons learned. Often organizations will initiate efforts that are duplications or similar to other efforts. Solutions for these efforts will yield more than one viable technical alternative. The Army organizations will select specific HW/SW solutions without any knowledge of similar efforts or guidance on what HW/SW should be selected. This selection is also influenced by the vendors' marketing efforts. This results in more than one Army application being developed to meet the same requirement.

Advantages

§ On a local level, the use of the technology has produced many successes for organizations and has provided many "islands of expertise" for higher headquarters to draw from to develop corporate Army solutions.

§ Some applications developed for a specific functional area or application have closely reflected the requirements of a corporate approach for that specific functional area (examples include Automated Surface Danger Zones (ASDZ), FASTRAC, some of the maintenance management modules, ROOFER, PAVER, RAILER, etc.)

Disadvantages

§ A lack of corporate guidance and leadership has hindered efforts to develop interoperability between systems.

§ The existence of many point solutions can be a hinderance to the implementation of the technology because of the "comfort" factor that is developed by the user's familiarity of a system. In other words, it fosters an attitude of resistance to change.

D. CONCLUSIONS

The adoption of a "root" technology approach to the acquisition of hardware and software for Army geospatial systems would enable the Army to influence the technology. Today the technology is influencing the Army. As the Army waits upon the industry to develop new technology, they are doing very little to corporately influence its development.

The Army's HW/SW requirements would come closer to meeting the industries' products if the Army adopted a set of corporate and system independent guidelines and procedures (root technology tools applied to Army business processes). The root technology (see Chapter 5B-2, "Root Technology", and Appendix D, Train Analogy) would be the "toolkit" combined with the prioritized processes that would establish the Army's GD&S requirements, from which the Army's applications would be developed. If all the applications were developed using the same guidelines, interoperability would be built into the applications.

The community of Army GD&S users should work together with higher headquarters to establish and maintain the root technology tools and guidelines. The approach presented within this document is for the establishment of a funded GD&S technology team (see Chapter 5-D, "Role of an Army GD&S Technical Team") comprised of user level technical experts from across the Army. The establishment of such a team would become the vehicle by which the field and higher headquarters could work together to close the gap between the top-driven programs and applications, and those developed at a local installation level by the technical users.

If the Army wants the technology to be a vehicle to meet mission requirements in the twenty-first century. There should be an investigation of need for such restrictive and cumbersome procurement regulations for automated equipment. The current procedures and regulations drive up the costs of the acquisition of HW/SW and actually prevent many organizations from acquiring the tools they need to perform their mission when they need them.

In summary, to increase the Army's investment in the technology a pro-active stance should be taken to define the requirements of the root technology, the tool box from which Army applications would be

developed. Once the tools are defined, the users could apply them to meet the specific installation needs. The Army should also implement a framework or process so that, as the applications are developed, the technical accomplishments and lessons learned can be disseminated to others. This will allow related efforts to benefit and build upon the efforts of others. Such a framework or process would also be a vehicle to close the gap between the headquarters initiatives and the user driven point solutions for the benefit of the Army community.

10) TRAINING/EXPERIENCE

Training and experience represent the skill levels that must be acquired by installation personnel to effectively utilize GD&S technology. Installation staff must acquire the knowledge and experience necessary to perform their existing duties and to be prepared to face tomorrow's challenges. Some installations have implemented GD&S technology in planning, environmental, and engineering areas because they have the resources and have developed a level of knowledge to implement the technology. The challenge is to introduce GD&S technology where it will produce the most benefit with the least impact on existing operations. There are many functional areas that can benefit from GD&S technology, but are unable to achieve the level of knowledge and experience necessary to implement and sustain the technology.

The experience levels that organizations need will vary depending on their staffing and the complexity of their applications. There are three general levels of GD&S experience/abilities. Team GD&S and other Army representatives recommended these levels to the Assistant Chief of Staff Installation Management (ACSIM) for the Real Property Management Tool (RMAT) (Reference item "C"). These levels represent some basic distinctions between skills that may be required within an organization and are as follows:

§ Level-1 (General User). The majority of users are casual or indirect users of GIS data. These include commanders and senior managers, as well as functional users who do not modify the database of record, but have a requirement to view the data.

§ Level-2 (CADD/GIS Technician). The level 2 configuration requires a skill level necessary for the majority of tasks required to create or maintain spatial data. These are application specialists that produce the majority of the products using the GD&S tools.

§ Level-3 (System Administrator). This level of configuration requires skills to create data tables and files, and control access to data and equipment. They would also be the staff to manage servers.

A. GOAL

1. Establish a knowledge base of technical in-house expertise at multiple levels (Department of the Army, MACOMs, installations etc.) within the Army.

B. OBJECTIVES

1. **Identify and** maximize the **use** of the **existing** centers of expertise (Installations, Districts, Labs, etc.) in the Army.

2. **Identify** the **existing areas** of **in-house expertise** and develop a **plan for mentoring** this **expertise** to other FOAs that provide military installation support.

3. The existing expertise **centers** should **work together to** develop a process to **mentor** GD&S **skills** and to facilitate **technical** transfer across multiple organizations **for** the purpose of **installation support**.

4. **Identify** the **opportunities** and **constraints** for **regionalizing** GD&S **support** services to installations.

5. Officially **sanction, fund** and **empower** an Army **technical team** to facilitate the achievement of objectives 1-4.

6. **Develop technical career paths** (opportunities) in multiple levels of the Army, **based** on a person's **GD&S technical knowledge**, skills and abilities (**KSAs**).

7. **Develop** a validation **process** or certification criteria for the **GD&S KSAs required** for the different **levels** (1-4 Reference item "C") of users.

8. **Establish a training guide** for people to meet the KSAs required for each level of GD&S user (Reference item "C").

9. **Match** the **technology with** available **skills of** the **organizations' staff**.

10. **Coordinate training with availability** of the user's **data** and **hardware**.

C. EXISTING CONDITIONS

Advantages and disadvantages are relative to a localized situation. The following sections describe typical situations within the Army today:

1. Tri-Service CADD/GIS Center's Mission is Purple - The Tri-Service CADD/GIS Center has accomplished a herculean effort to bring the Tri-Service Standards to its level of completeness today. It is recommended that future GD&S initiatives use the standards for the structure of their data. The Center's mission is a tri-service mission that includes upward coordination of issues and duties relevant to all the services in DOD. They do not have the technical resources to provide direct support to Army installations nor do they have technical staff dedicated to the management of technical issues related exclusively to the Army. Their mission is engaged when it is a tri-service issue.

With the Center's tri-service mission, there is a void in the Army as to which organization has the technical resources and the mission to manage the technical issues within the Army. Current conditions point to several installations, districts, and laboratories that have the technical expertise. USACPW probably has the mission but not the staff. Several districts and laboratories have technical expertise, but not the mission.

Advantages

§ The Army's participation in tri-service initiatives provides value and enhances the use of GD&S within the Army.

§ The Tri-Service Geospatial Data Standards provides the framework for the implementation of a standard method for organizing the geospatial data and a basis for implementation of a corporate approach for the Army.

Disadvantages

§ There is no leadership within the Army (ACSIM, USACPW, MACOMs, Installations, HQs USACE/districts and laboratories) for the coordination of technical issues, development of corporate GD&S solutions and technology transfer for the benefit of the Army as a whole.

§ Lack of a corporate focus and approach for using the technology promotes point solutions and duplication.

§ Organizations are unaware of others' expertise.

2. Lack of Training for Applications Specific to the Management of an Installation - There is no corporate guidance for GD&S training options. The majority of training opportunities are formal classroom training for vendor specific products.

There should be training opportunities for the installation staff to learn GD&S skills using their data applied to their specific work requirements. Most people learn the technology by using it to perform their job duties.

Advantages

§ Formal classroom training is readily available.

Disadvantages

§ Lack of training experiences that relate to the installation business processes and applications required to meet the installation's mission.

3. Technical Expertise is Hired via a Private Contractor - Some installations have chosen to contract all of their expertise. The contractors' duties range from specific tasks or projects to the total

management of the system(s). When a contractor manages the total system they will often work on-site with the installation staff.

Advantages

§ Personnel moves do not affect the operation of the geospatial system.

§ Expertise can be acquired immediately.

§ A contractor works from a specific scope of work which buffers them from the bureaucratic red tape, meetings, and "other duties as assigned" that government employees have to address.

Disadvantages

§ No institutional knowledge base is established.

§ The organization may become too comfortable with the contractor's service, to the point of being detrimental to the government. Over time, the government becomes complacent about the customer/contractor relationship and can become lax in the reinforcement of the terms of the SOW.

§ Contractors are not always the less expensive option.

4. Technical Expertise is Contracted to Another Government Organization - In this example, an installation develops a partnership with another government agency (a Corps district, laboratory, or another installation). Typically, the in-house personnel have the time and expertise to meet the daily GD&S operational needs and the other agency acts as the installation's second or third level staff member. The types of duties performed by the other agency range from managing or producing specific products for a project, developing new applications, procurement of HW/SW, and system maintenance, to managing the total system(s).

Advantages

§ If a team chemistry (personalities, common goals, clear responsibilities, etc.) is developed and this scenario can produce dividends.

§ Provides the installation access to a wide range of GD&S experts without the need for a SOW.

§ Partnering with another agency produces an extension of the installations' staff without the installation having to manage all the overhead issues.

§ If the agency can provide the GD&S service to multiple installations, there are additional benefits (a critical mass of expertise, reduced costs, promotion of common solutions, etc.) that can be realized by multiple Army organizations.

§ No SOW is required to start work or make changes. The transferring of funds initiates the efforts

Disadvantages

§ If team chemistry can not be developed, this approach will fail.

§ The expertise may not be on-site when it is needed.

§ Remote technical support is dependent on the reliability of WANs and LANs.

§ The physical distance between the agency and the installation can be a problem.

5. Technical Expertise is Developed and Sustained Within the Organization - In this scenario, the organization acquires the in-house expertise as a part of their government staff. Acquisition of staff members with the technical knowledge is accomplished by hiring a degreed person or by re-training current employees. However, when a

person is hired from outside the organization for their GD&S technical skills, they often will not have the institutional knowledge of the organization or the business process.

Advantages

§ Establishes in-house capabilities within the organization.

§ Re-training of staff is a method to use in situations where full time equivalents (FTEs) are hard to acquire.

§ The hiring of employees with a degree (in a GD&S field) is the fastest method to achieving in-house expertise.

Disadvantages

§ With the downsizing of staff at installations, it is difficult to gain the FTEs.

§ It is difficult to hire people with a degree because they can command a higher salary in the private sector.

§ When an employee has GD&S responsibilities, along with several other duties, the GD&S responsibilities are usually a lower priority. This is especially true in a reimbursable situation where a person's time is billed to a charge number.

§ Once a person has developed GD&S knowledge, skills and abilities, they will often leave the organization.

6. Technical Expertise is Established via a Combination of Approaches - In this situation an installation will use a combination of the previous examples for accessing expertise.

Advantages

§ Provides the most flexibility to an installation. They can "gear-up or down" depending on the workload and the methods that they have established to access GD&S expertise.

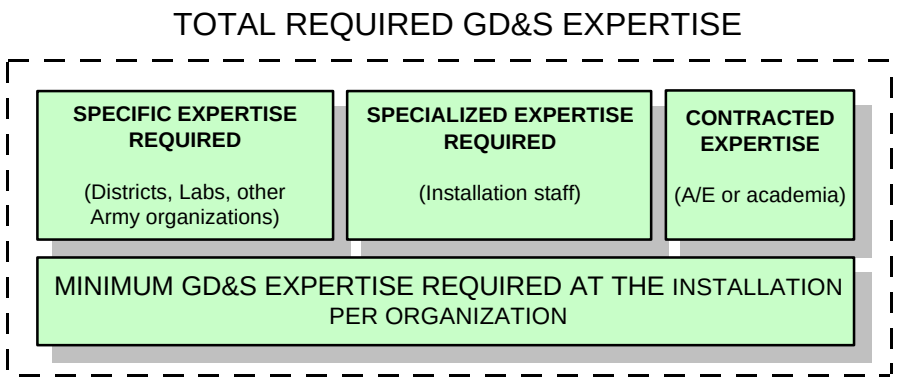
Disadvantages

§ Requires more coordination and communication between the installation, contractor, and other agencies.

D. CONCLUSIONS

Each service should be pro-active in charting a course that meets the mission requirements of their service. The Tri-Service Center should become the vehicle by which the services partner to obtain common objectives. The areas of expertise within each service should be a resource that the Center can draw upon to assist them in the implementation of the technology.

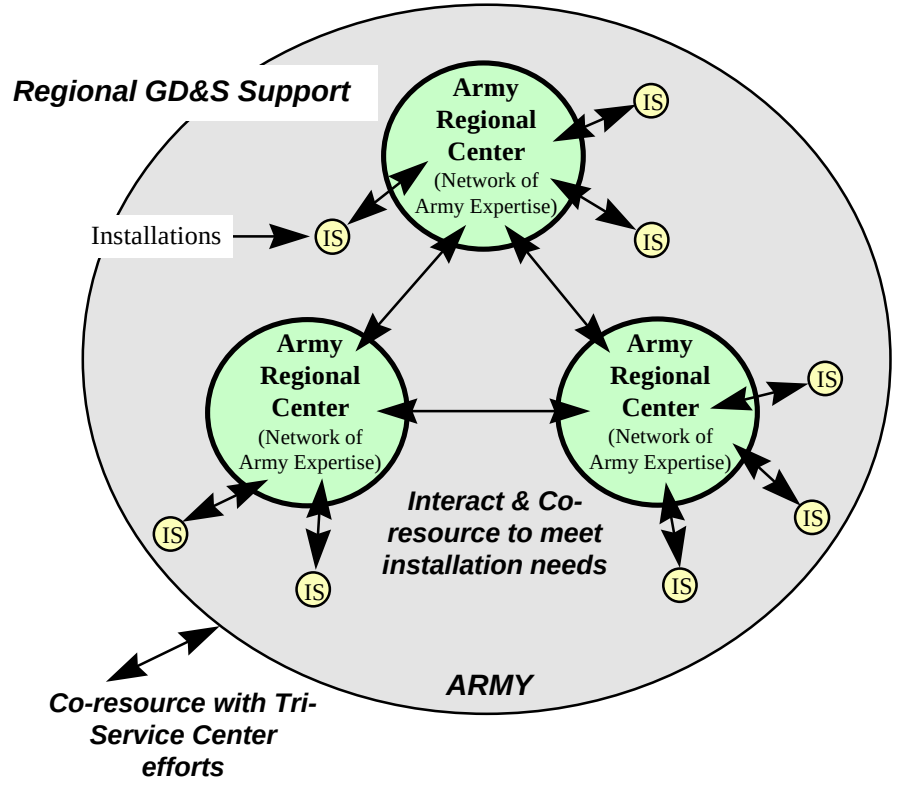
Installations should investigate their options for acquiring GD&S expertise (retraining of in-house personnel, hiring staff with existing GD&S skills, partner with other Army organizations, contractors, university). The installation's GD&S expertise should not be totally dependent on outside organizations. A combination of the methods is a desirable approach because the organization(s) can develop a nucleus of in-house GD&S expertise augmented by outside resources as the work load fluctuates. The combination for each organization will vary. The important issue is not to focus on a single option but to identify all opportunities and develop them.



10-1 Required GD&S Expertise

The Army should development a regional support plan for GD&S technical assistance to military installations. Acquiring experience does not happen over night, it is expensive and is an evolutionary process over several years. All installations do not need to maintain all skill levels (General User, CADD/GIS Technician, System Administrator) in-house. A regional concept would include the recognition of existing expertise within the Army. No single agency in the Army has all the resources to meet the demand for the technology (ie. CPW, Districts, Installations etc.). The Army must recognize and utilize its existing investment and pool this expertise to meet the needs. From the centers of expertise, GD&S support could be provided to multiple locations. The identified areas of expertise would partner with each other to provide specialized expertise to meet an installation's needs.

Implementation of a regional plan is technically possible but organizationally would be difficult. It would require organizations to change their attitudes and methods of executing their mission. Organizations would have to be candid and straight forward in their evaluation of each others' expertise and willing to work together. Organizations would have to abandon their self serving and parochial attitudes and adopt a spirit of cooperation and partnership for the purpose of providing the best possible service or product to the mission of the Army.



10-2 Regional GD&S Support Plan

11) DATABASE DEVELOPMENT

Database development represents the required graphic and tabular information collected and converted into a data model for a geospatial data system. The Tri-Service CADD/GIS Center in Vicksburg, Mississippi has compiled most of the essential geospatial data elements in the 'Tri-Service Spatial Data Standard' (TSSDS Version 1.4). The TSSDS data model should be used as a baseline organization for the installation's geospatial data.

The Tri-Service Spatial Data Standard (TSSDS) is an excellent data model to use as a starting point. Having the data structure is the first step. The implementation of the structure at the installations that have GD&S platforms was not completed at the time of the writing of this document. There are two approaches to implementation of the standards. One approach is to implement the total structure (a field for all data entities) and capture as much data as possible, as identified in the TSSDS. The second approach, held by most users, is to implement and collect data for the portions that apply to the specific installation. Data should then be populated based on a priority that is determined by the number of users who require the data. It should be noted that having the TSSDS does not replace the need to understand the utilization of data or replace the database design phase.

Data collection is the most expensive part of an implementation and should be cross-referenced with the task or function to be performed to limit collection to the necessary data that can be maintained by the organization. This approach enables installations to identify the priority data that is required for a functional area (Real Property Master Planning, Range and Training, Engineering, and Environmental) or business process without undue expense.

The Savannah District Corps of Engineers has begun the process to match data requirements with functional processes. The resulting matrices will finally enable users to determine data collection based on the prioritization of the installation's needs (see Appendix G).

A. GOALS

1. **Maximize** the **return on investment and usability** of **data collection** efforts for geospatial data systems.

2. **Develop** a virtual **corporate database** that is **driven by use and accuracy**.

3. **Balance** the **data** (amount and cost) **to** your **needs**.

B. OBJECTIVES

1. **Identify, analyze** and **prioritize** your **data needs**.

2. **Share resources and data** needs for maximum return on investment (ROI).

3. **Prioritize and collect** data **based** on the number of **users that** can **benefit** from the use of the data.

4. **Develop Data-Application-User-Models** for each product to be produced with a geospatial data system (refer to Appendix G).

5. **Collect data once and share it among multiple users**. As the "need to know" arises, the functional area responsible for managing the data should update the data.

6. **Determine** the **data** and **accuracy** required **for corporate use**. Functional areas (responsible for managing specific information) will typically require a more detailed degree of accuracy and completeness than corporate (casual) users.

7. **Establish** and **maintain** a **corporate repository** (library of spatial data) at installations.

8. Develop and **implement techniques to avoid re-inventing** the same data for multiple users.

9. **Utilize** the **"root technology"** tool box to develop the databases.

10. **Determine** data **collection priorities based on** the following three **issues**:

* regulatory requirement
* the frequency of the data access
* The numbers of users who need the data

11. **Establish** an **approach and process** that will create opportunities **for partnering and co-resourcing between** the **Army and** the **private sector** for the development and implementation of Army GD&S applications.

C. EXISTING CONDITIONS

The following sections outline existing database development conditions:

1. No Corporate Approach to Data Collection - Traditionally, data has been collected by a specific functional area for an application without regard for others who may have a need for the same or similar data. There is often no attempt to communicate with other functional areas on the installation for possible interest in the same or similar data elements prior to the collection of data.

Advantages

§ The functional area that collects the data, or the user of a specific application is the only organization that benefits from the collection effort.

Disadvantages

§ Increases the chances for duplication of data collection efforts.

§ Several functional areas collect and maintain data for the same topics (data duplication).

§ Functional areas are not aware of the data that other functional areas of the installation have.

§ Collection efforts yield a lower return for the dollars invested.

2. Too Much Data or Not Enough Data - Identification of data and quantities to be collected for a specific function are challenges. One approach is to collect all the data possible for a collection of initiatives. Another approach is to collect only the amount of data that an organization can maintain and keep current for a specific initiative.

Organizations often do not have the data they need to implement the technology. Functional areas of installations usually have too little or too much data, or a wrong format. Installations often have more data than they can effectively use or maintain. In other examples, the data has so much detail that it is too cumbersome to use or manage. At other times, the installation lacks enough data, or the data is in the wrong format to operate within a geospatial data system.

Advantages

§ Some data may be better than no data.

§ The data is available to answer some questions.

Disadvantages

§ A reduced return on investment.

§ Corporate records of what data has been collected rarely exist (metadata, data about data).

§ The data can not be used for decision making.

§ Lack of adequate storage and system administration resources to update or maintain the data.

3. Duplication of Data - Stovepipe data collection efforts have created a situation in which data is collected and maintained in several locations.

Advantages

§ Functional areas or geospatial systems sometimes require the data to be in more than one location to optimize the access time.

Disadvantages

§ No revision control. Each functional area maintains its own data, often in a variety of formats.

4. Inaccurate or Outdated Information - Collection of data without an understanding of the requirements to keep the data current has led to a large amount of data within the Army that is not usable. Data is collected for a single purpose and often used once, or is collected in such detail that is never updated and becomes outdated. Sometimes conversion of old data into a suitable digital format is a good first step, even though the data may be outdated.

Advantages

§ The ability to access and use outdated data is better than having no digital data.

Disadvantages

§ Reduces confidence in the technology when bad data is used.

§ The information can not be used for decision making purposes.

§ Limits the use of the data.

5. Existing Data Format Can Not be Used by the Application - The format of the data is an important issue relative to the usability within a GD&S. The data may have been developed several years earlier and may not fit into today's database structures. Without the existence of a corporate database standard, every group with an initiative to collect data adopts their own database structure.

Advantages

§ Some data is affordable to convert into a usable format.

Disadvantages

§ The data can not be used in a geospatial data system.

§ Costs associated with converting the data into a usable format may be too high.

D. CONCLUSIONS

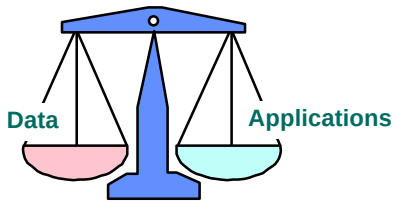
Data is the heart of any GD&S system. Data collection is the most time consuming and costly component of implementing a GD&S. Therefore, it is essential to identify the priority applications that the installation's GD&S will be able to support. The data required to perform those applications and the users who maintain and utilize the data should be identified in a matrix so that the organizational users' roles and responsibilities can be clearly delineated and the associated costs justified.

A recommended method to identify the priority data collection needs is to develop a Data-Application-User Model (see Appendix G) that establishes the relationships between applications, required data and users. The model captures required applications, required data to complete an application, and users who will benefit. It also provides a

tool for prioritization of data to be collected, so that the maximum benefit can be achieved with data collection funds.

The amount of data collected should be balanced to the application. Collect only the amount of data that an organization can manage or prioritize the data that is collected based on the number of users who need the data elements.

Balance Data With Applications



- Define Data (Why do I need it?)
- Define Applications (What does it do?)
- Data Required For Applications (What data do I really need?)
- Prioritize Data (Highest return first)
- Who Uses/Needs the Data (Cost Share)

11-1 Database Development

In some cases, there may be a need to collect specific data that is not used by many, but will keep the installation in compliance with regulations (ie. cultural or environmental survey data). Collection of data that does not meet the criteria mentioned above is not a wise use of funds.

The lack of a common (corporate) approach to the development of databases results in point solutions that do not work together. If a corporate approach to the collection and management of data was implemented at Army installations, additional benefits and reduction of data collection costs would be realized.

12) CONCLUSIONS

Given today's climate of shrinking resources and an increasing demand to provide for home Base Forces, it is impossible to meet mission readiness without a dramatic shift in the way installations process data. **Geospatial Data and Systems technology provides a tool that, when adopted and supported, will enable organizations to fulfill their mission requirements and improve readiness.**

The Geospatial Data and System (GD&S) paradigm will result in a shift from traditional manual decision support procedures to an approach that uses GD&S as an integral part of the decision making processes. The Army must strategically pursue efforts to harness computer tools to enhance the installations' capability to execute their missions. This document is Team GD&S's attempt to identify the components of a new management and engineering paradigm for the Army's use of the technology.

The Army identified and documented its vision for installation management (*Installations: A Strategy for the 21st Century*):

Army strategy:

The Army strategy is to build and support a total force, trained and ready to fight, serving the nation at home and abroad; a strategic force capable of decisive victory.

The second step was the establishment of the Army Installation Management Action Plan (IMAP) as a tool to achieve this vision.

Installation strategy:

The installation strategy, derived from the Army strategy, is to build and support a total team of active, reserve, guard, civilians, and contractors to improve the quality of facilities and services; to build partnerships with the local community; to be environmental stewards; and to provide a strategic power projection base for America's Army.

The Army's IMAP identified an Army installation planning process that should be applied to the adoption of GD&S technology. The Army's installation management planning process consists of three components:

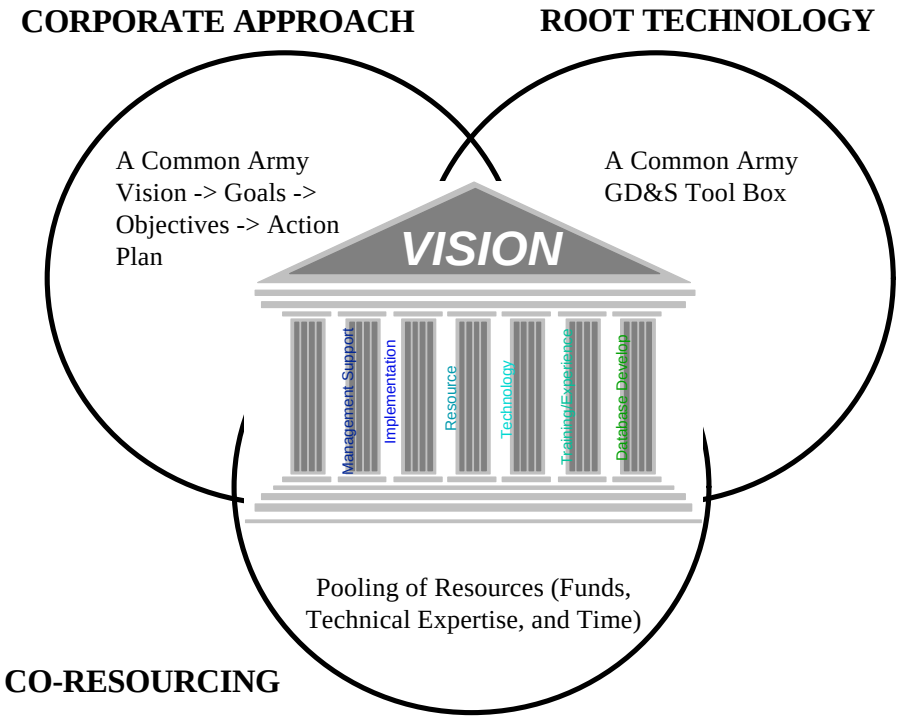
* Army installation vision and strategy;
* Army implementation guidance;
* Installation action plans to implement the vision and guidance.

To meet the Army's goals for the 21st century, the Army must apply the same planning process and emphasis to GD&S technology that it does for the other installation management activities.

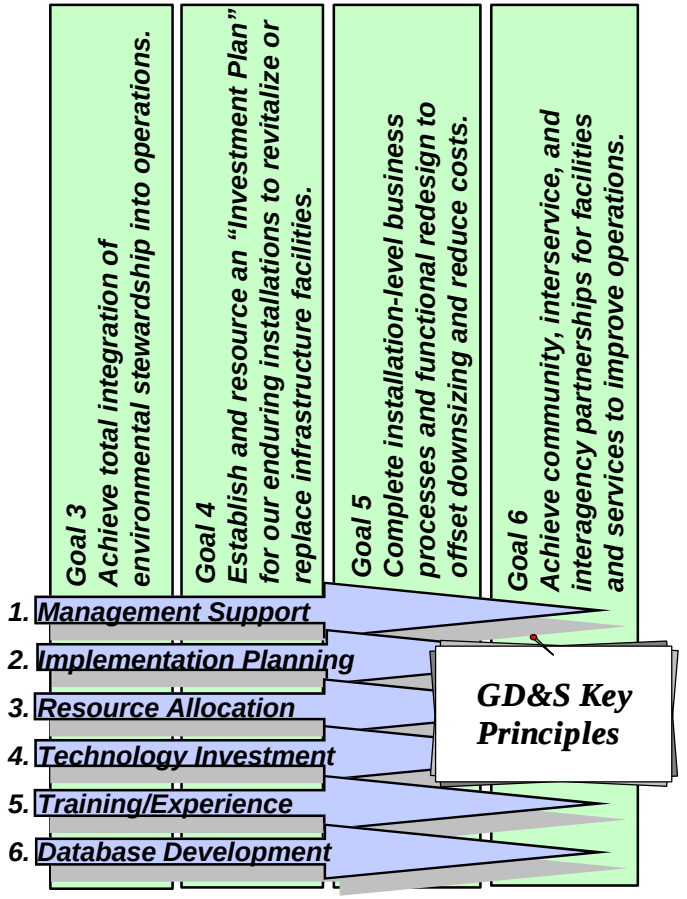
Geospatial Data and System strategy:

The Army's Geospatial Data and System strategy, derived from Team GD&S's experience and applied to the installation strategy, is to build and support a real property database that enables installation managers and engineers to make better decisions; to meet today's requirements for accurate and timely geospatial data; and to sustain base development and compliance in the face of reduced resources and increased demand for services.

This document establishes a vision and strategy for GD&S technology in the Army from the perspective of the Army GD&S users. The Army's Geospatial Data and System Strategy, a technical user's perspective, is based on three themes (root technology, corporate approach, co-resourcing) which are inherent to the six key principles. Refer to the Figure 12-1 on the next page.



12-1 Three Common Themes

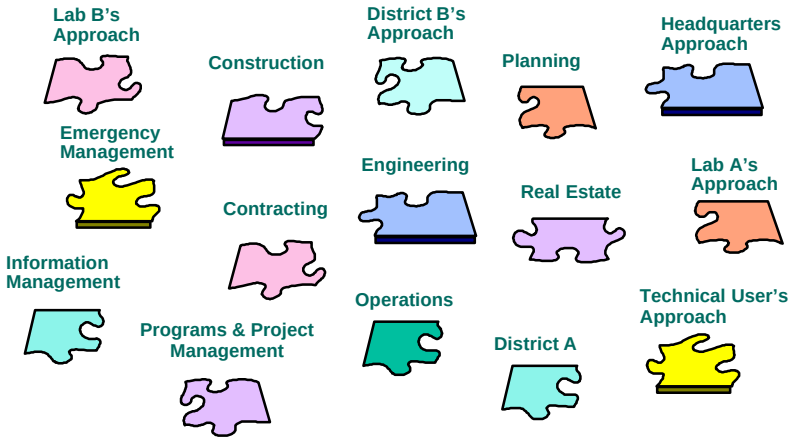


12-2 GD&S Key Principles

GD&S is a tool that can be used to assist the Army in reaching its goals identified in Installations: A Strategy for the 21st Century.

2-1 Army GD&S Vision

Where Are We Now?

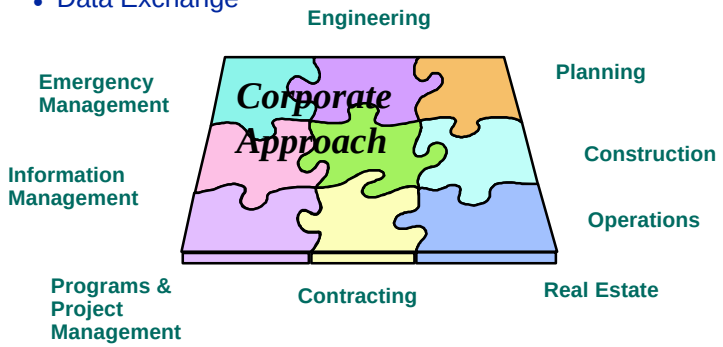


"Islands of Expertise"
Within the **Traditional** & Organizational Boundaries & Stovepipes

12-3 Islands of Expertise

Where The Army Should Be

- **SHARED DATA:**
  - Data Knowledge
  - Data Exchange



12-4 Corporate Approach to Spatial Data Management

The six principles provide a framework that could be expanded to provide a template for evaluation and the prediction of benefits and expectations of GD&S initiatives. Each of the principles requires periodic evaluation during implementation of the technology (prior to expenditure of funds, during implementation, post implementation and for sustainment and technology transfer initiatives). For the investment in the technology to reach its potential, a balance of the six elements is required. If these principles are out of balance, the benefits of the technology will not meet expectations or the required return on investment.

The vehicle to execute the objectives of the strategies is the establishment of an Army GD&S technical team that would work with installations, HQDA staff, and with others (Districts, labs, etc.) to develop an installation regional support plan to facilitate the transfer of technology, lessons learned, co-resourcing of funds, manpower and initiatives for the benefit of the total Army. Currently the Army has no GD&S vision, strategy or corporate focus for the implementation and sustainment of geospatial data and systems technology. The Army continues to commit, directly and indirectly, large sums of money to support GD&S initiatives that collectively have no corporate vision, guidance, or measurement of success. Use of geospatial data and systems technology is multi-faceted: maximize its existing investment in the technology (areas of expertise); combine that experience with the private sector; and adopt an incremental implementation approach ("start small, think big and someday get it all, versus start big become small and get nothing done at all"), yielding both short term and long term benefits to the sustainment of the forces at Army installations. **Adoption of a corporate approach would create the roadmap for the development of integrated solutions that would meet the corporate business goals of the Army.**

Team GD&S has identified a grass-roots vision, goals and objectives for the adoption of the technology in the Army. We challenge the senior leadership in the Army and fellow technical users to work together to

develop action plan(s) to apply the principles identified herein. The adoption of the technology and its benefits to the Army is centered on the organization's ability to solve the social, political and organizational issues, not the procurement of more hardware and software.

Accomplishment of the GD&S vision will require the identification of Army organizations and individuals who are flexible, innovative, work well with others, and feel challenged to meet the demands of change. It will require a willingness for organizations to take a stand and support the vision with a dedication to carrying out the goals and objectives. Organizations must adopt an attitude of doing what ever it takes to get the job done and doing it with resourcefulness and willingness to take risks. Only with this commitment and attitude can the Army realize the benefits of GD&S technology for the 21st Century

APPENDIX A:

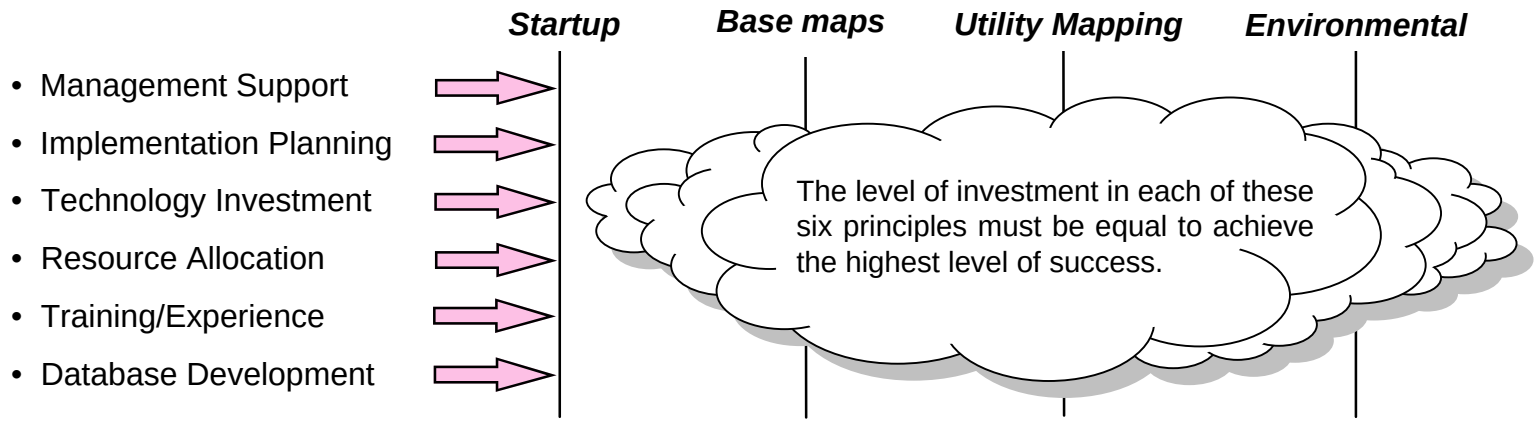
Executive Brief

Introduction:

The Army has many functional areas that require the ability to access vast amounts of data to meet their mission readiness requirements and to support their decision process. Geospatial data and systems provide the tools to collect, manage, analyze and present data. However, meeting the mission challenges does not depend on the technology alone.

This report identifies the relationships that exist between installations' functional areas, the processes they perform, the products they produce, and the Army programs they support. It is intended to give a grass-roots perspective from the Installations' points of view. Installations of the 21st century must have a plan of action to implement Geospatial Data and Systems (GD&S) that will enable them to leverage their limited resources across functional areas and across programs. Six (6) key principles that relate to GD&S success have been identified by installations:

> **Installations: A Strategy for the 21st Century**
>
> Installations of the 21st century must have the capability to train, mobilize, deploy, sustain, support, recover, and reconstitute mobilized operating forces....



Goals:

To harness GD&S computer tools, the Army should adopt the following goals:

- Develop an Army wide GD&S implementation strategy;
- Develop GD&S databases at the installation level that meet the Tri-Service Spatial Data Standard (TSSDS) as published by the Tri-Service CADD/GIS Center at Vicksburg, Mississippi;
- Reduce the costs and resource requirements necessary to fully implement and support GD&S technology;
- Train and establish GD&S users at every Installation.

Advantages of GD&S Technology:

When a water main break occurs, a GD&S user is able to display a map of the installation on a workstation and quickly pinpoint the location, identify shut off valves and prepare a list of materials that will be needed for the repair.

Objectives:

There is a requirement to provide command level guidance and direction for the implementation of GD&S technology. Installations have implemented many systems that enable their functional units to meet mission requirements. The development of a GD&S Strategy requires that installations' functional solutions be part of an overall Army Strategy with the following objectives:

- Establish standards for the collection, management, analysis and presentation of geospatial data;
- Establish a GD&S technology group to assist in the development and establishment of appropriate solutions and implementation approaches;
- Establish investment strategies for programming funds for GD&S investments.

Recommendations for a Geospatial Data System Strategy:

To ensure that GD&S investments are maximized to their fullest potential, the Army should establish a framework for how GD&S technology should be developed and implemented as part of a corporate solution. The following recommendations are presented in support of the installation's mission:

- Establishment of a corporate strategy for the implementation of GD&S technology at Army installations;
- Establishment of GD&S processing standards and guidance for Army engineers;
- Establishment of a partnering program with Army organizations (labs, Districts, MACOMs, installations) and commercial vendors for the development of GD&S technology and databases;
- Integration of Standard Army Management Systems (STAMISs) that require common data across functional areas (such as RMAT).

Advantages of GD&S Technology:

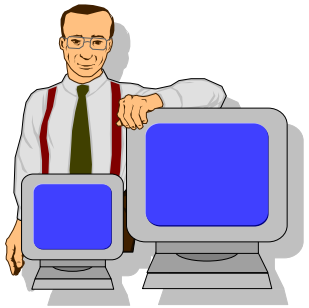
When an Installation is preparing to take on a new mission, the GD&S user is able to display a map of the installation, locate existing mission constraints and identify installation assets that will enable them to meet the new mission requirements.

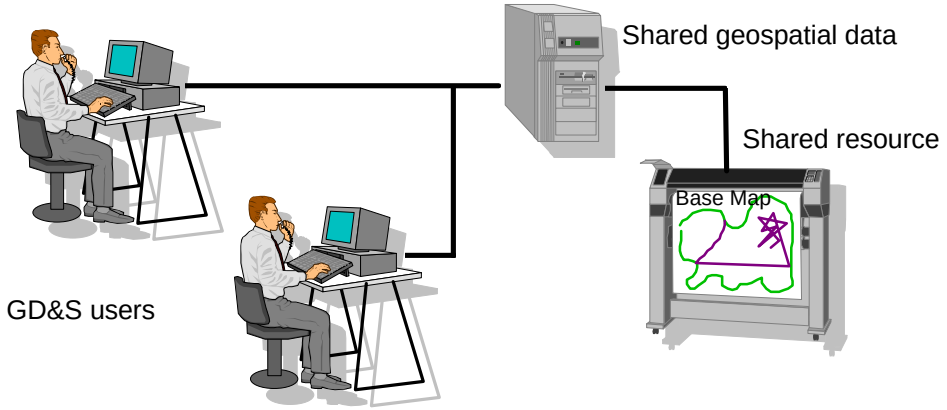
The Requirement for GD&S Root Technology:

GD&S Root Technology provides the baseline capabilities necessary to develop and integrate geospatial data across functional areas that enable GD&S users to more effectively meet mission requirements. The Army GD&S Root Technology must specify the standards and integration requirements for the development of GD&S solutions.

Commercial Root Technology

Hardware, software, database and graphics engine.





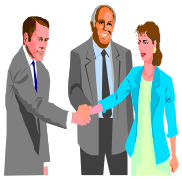
Geospatial Data and Systems Principles Overview

Geospatial Data and Systems must be implemented via a process that enables the installation staff to support the Commander's plan for the management and development of real property assets of the installation, including lands, facilities, and infrastructure.

The GD&S roadmap for success describes the appropriate level of commitment that must be made for each key principle. These principles form the foundation for establishing successful GD&S implementations. The GD&S roadmap also ties the Army's existing installation level investments together to form the foundation of the Army's GD&S strategy.

Advantages of GD&S Technology:

When an Installation is preparing to develop and/or revise its Real Property Master Plan, the GD&S user is able to assess that facilities meet known and future mission requirements, that land areas are environmentally and functionally suited to meet mission objectives and assists the Commander in the evaluation of alternatives and decision making.

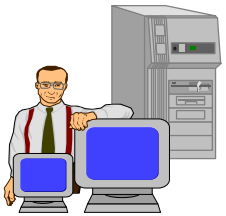


Management support

Resource Allocation

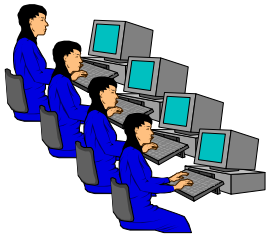
Roadmap for success

Implementation Planning



Technology Investment

Training



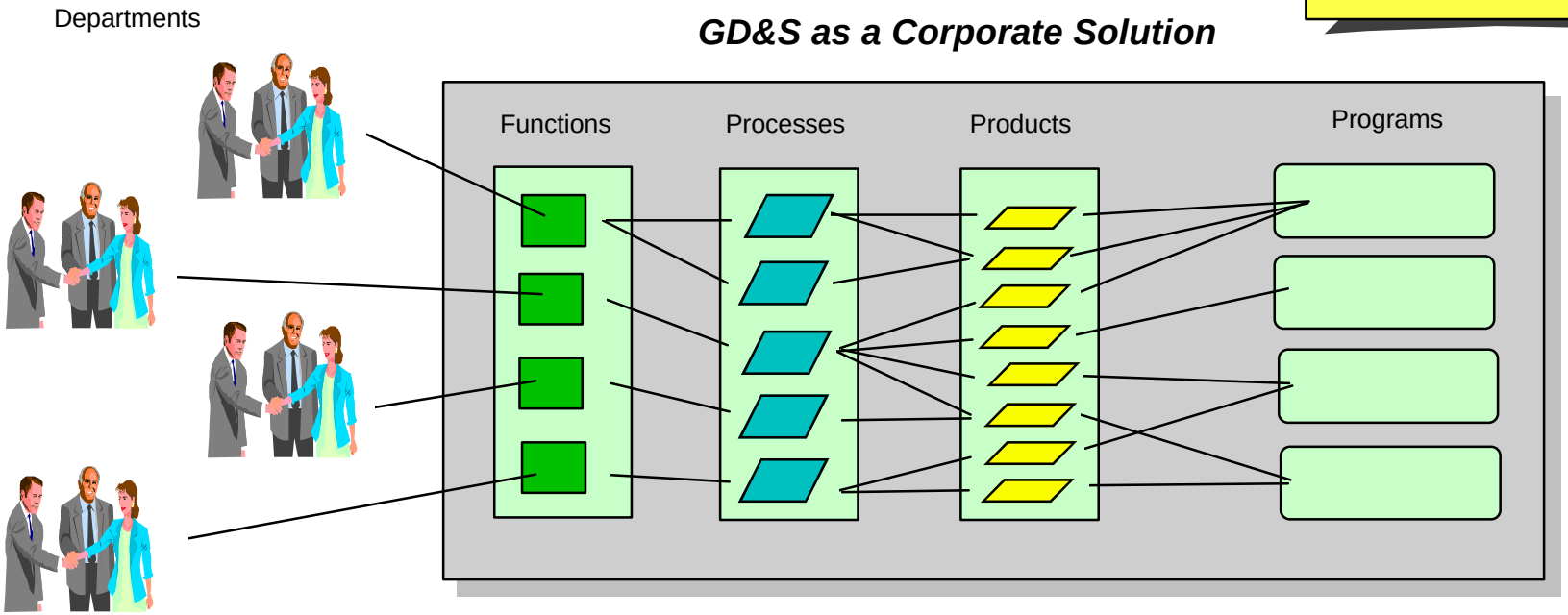
Database Development

Management Support

Management support is the most important principle that determines the success of GD&S at an installation. Management support represents the required roles and responsibilities of local management that are necessary to successfully implement GD&S technology. It is key to ensuring that GD&S technology is implemented as a basic foundation to develop a corporate solution where all common data is easily accessible and shared by multiple departments.

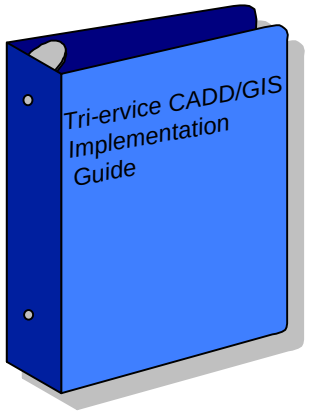
Advantages of GD&S Technology:

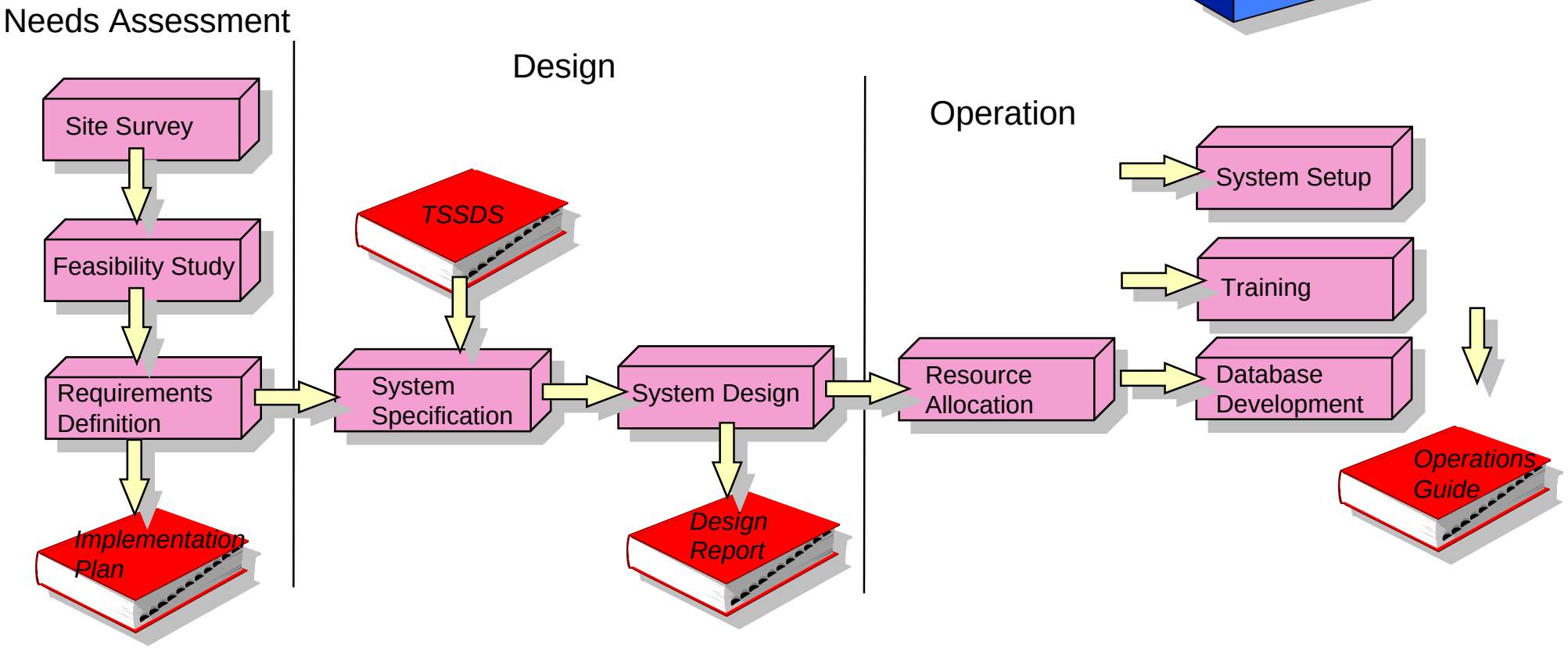
When an Installation is preparing to locate a new facility, the GD&S user is able to define land use goals and objectives, and analyze those of the surrounding region. The land use process is iterative, requiring continual reassessment based on feedback and changing goals and objectives. The GD&S user is able to process complex base map overlays from multiple departments and assemble the results in clearly defined tabs to improve decision making.



Implementation Planning

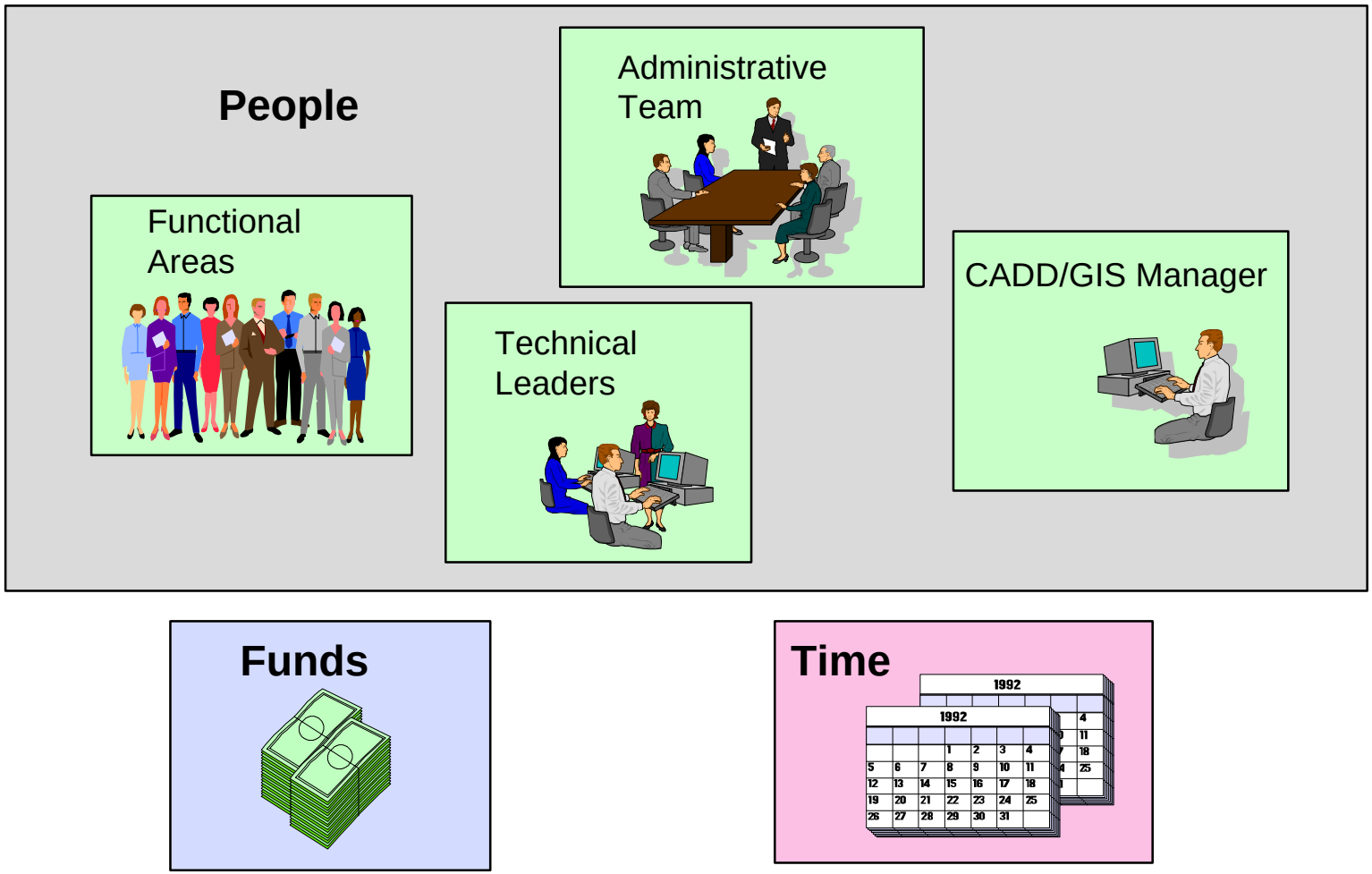
Implementation Planning represents the preparatory planning tasks that are required to successfully install and operate GD&S technology within an organization. The implementation planning process is useful in achieving a balance between information and the knowledge of how to process the information more effectively with limited resources. The most successful installations have participated fully during the needs assessment, design and operational stages of the implementation process. To facilitate installation participation in the implementation process, the Tri-Service center in Vicksburg prepared a Tri-Service CADD/GIS Implementation Guide that contains guidelines to assist in the implementation planning process.





Resource Allocation

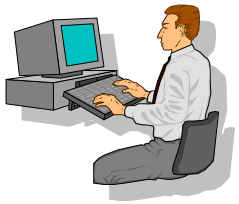
Resource allocation represents the time, manpower, and funds required to implement and maintain GD&S technology. There should be a balance of the three resources within an organization. The implementation planning process includes the identification of resources that an organization(s) will need to produce the desired results.



Technology Investment

Technology investment represents the required hardware and software that an installation must purchase to establish a GD&S platform. There must be a balance between what the installations purchase and what they require to achieve their goals. The proper level of investment in technology should be determined during the needs assessment early in the implementation planning process. The Army's GD&S strategy must include guidelines for installations to follow when purchasing GD&S technology and should not allow the installations to be driven solely by vendor objectives.

Single User System



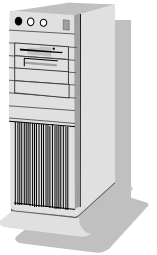
(Stand alone user)

Departmental System

(Two or more users on
a departmental network)

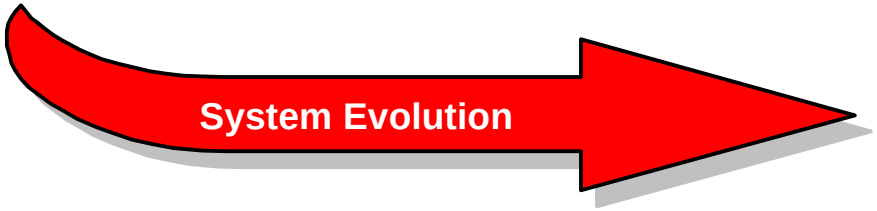
Corporate System

Shared Data



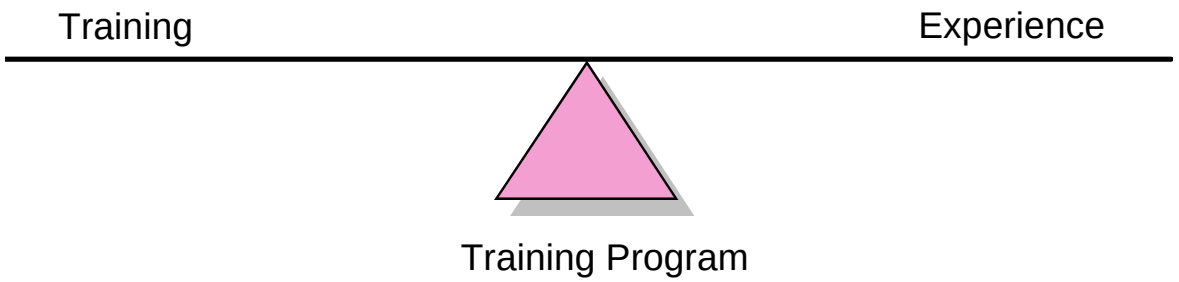
Installation Network

(Two or more departments on
an installation network)



Training/Experience

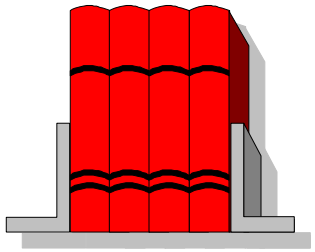
Training and experience represent the skill levels that must be acquired by installation personnel to effectively utilize GD&S technology. Installation staff must acquire the knowledge and experience necessary to perform their existing duties and to be prepared to face tomorrow's challenges. There are many functional areas that can benefit from GD&S technology, but the level of knowledge and experience necessary to implement and sustain the technology must first be obtained. The Army's GD&S strategy must include guidelines for establishing the proper approach to training and the requirement to establish an appropriate training program. Today's training programs include standard classroom training at the vendor's facility or at the installation, and onsite customized training. The trend is toward customized training that utilizes the customer's data and procedures, and results in a training program based on standard operating procedures.



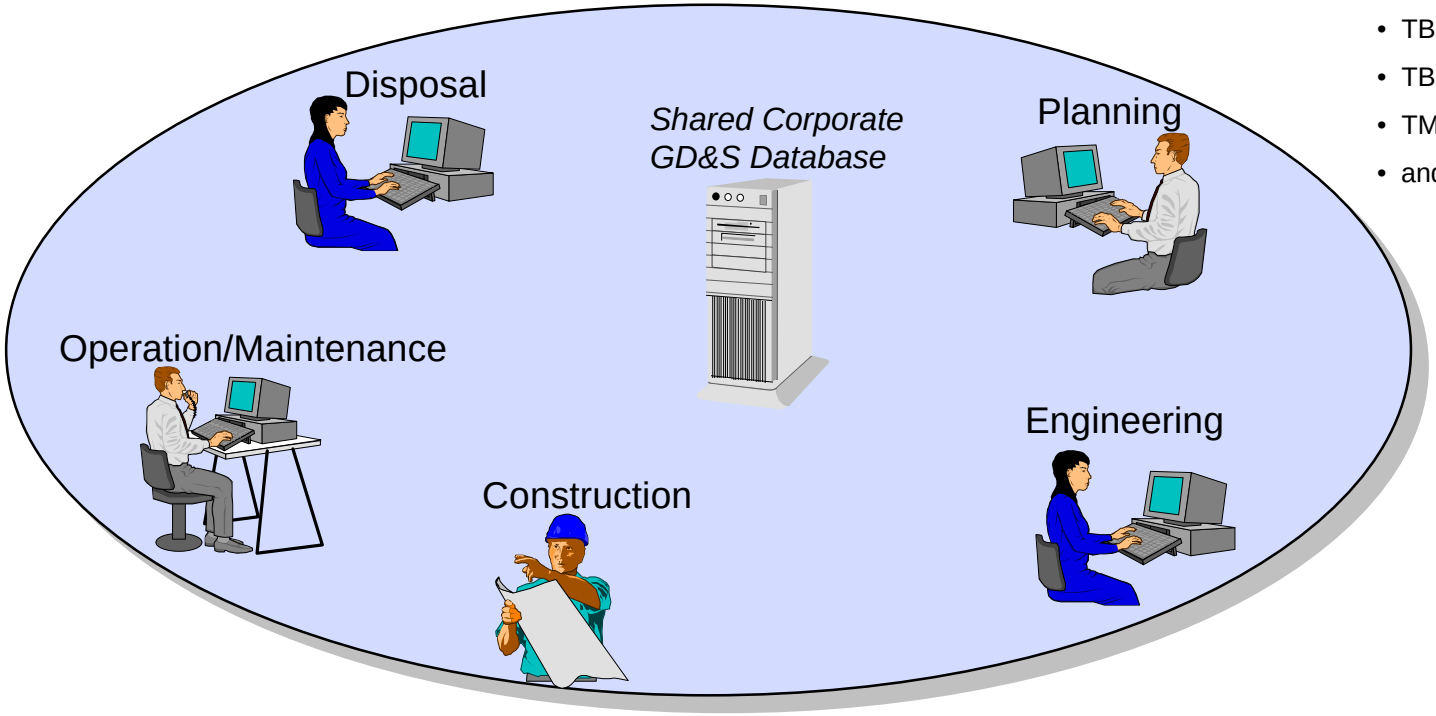
The training program must establish a balance between the appropriate level of training required for user staff and the requirement to obtain experienced resources from outside sources.

Database Development

Database development represents the required graphic and tabular information collected and converted into a data model for a geospatial data system. The Tri-Service CADD/GIS Center in Vicksburg, Mississippi has compiled most of the essential geospatial data elements in the Tri-Service Spatial Data Standard (TSSDS). The TSSDS data model should be used as a baseline organization for the installation's geospatial data. In addition, there are multiple regulations and documents that describe how to develop, maintain and utilize GD&S databases to support a variety of Army programs. The Army's GD&S strategy must include funding and identify the process required to migrate all installations to the same GD&S data dictionary. The Army's GD&S strategy must also include a corporate approach to the integration of GD&S databases across functional areas and programs.



- TSSDS Tri-Service Spatial data standards
- AR 210-20 Master planning guide
- TB 5-803-1.1 Automated mapping guide
- TB ENG 353 Master plan preparation
- TM 5-441 Topographic surveying
- and others



Recommendations

1. Establish a GD&S implementation plan for each installation.
2. Establish Army wide geospatial data and processing standards.
3. Develop a multi-level (General User, CADD/GIS Technicial, System Administrator) GD&S graphical user interface.
4. Establish an electronic/digital basemap at each installation.
5. Establish an Army GD&S technology group to oversee and support GD&S development and implementations.
6. Provide avenues for the partnering between Army organizations and the private sector to enhance and benefit the use of GD&S technology.

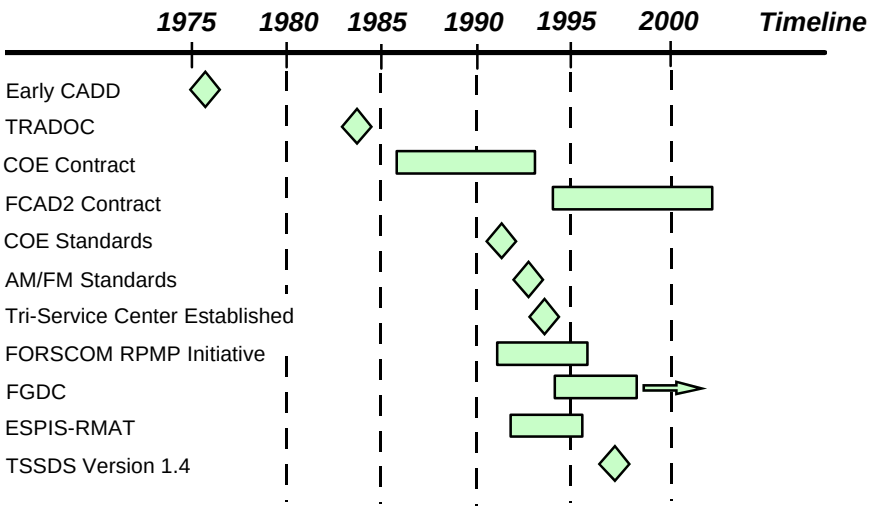
APPENDIX B:

Background of GD&S in the Army

BACKGROUND - GD&S in the Army

GD&S in the Army began in the late 1970's. Early systems were used to automate drafting operations. In the late 1980's the Corps awarded a comprehensive CADD/GIS contract which was used to procure large numbers of systems that automate drafting, mapping, design, planning, environmental and facility management operations.

Today, Geospatial Data and System technology is employed by Army engineers to increase map making productivity and to analyze many layers of map/geographic data for better decision making by merging maps and tabular databases. Army Engineers use GD&S tools to link tabular data to specific graphic features, thereby increasing the value of the installation's data to the decision making process. Some Army installations have implemented Geospatial Data and System technology as a tool to assist them in Real Property Master Planning and Space Planning activities.



Timeline of Army GD&S Efforts

The Army has many functional areas that can benefit from Geospatial Data to meet mission requirements. The Army also has many programs and initiatives that establish guidelines and regulations for how each functional area should meet these requirements. The challenge facing most installations and functional areas is the lack of guidance on what and how technology should be implemented.

Many installations have implemented a variety of computer based systems that manage installation assets. Some of these systems were developed as part of Army programs and some were developed by individual Commands/Installations in response to their specific needs. These automated systems should focus on work processes performed 90% of the time in the daily work load and should be designed and configured to conform to the Tri-Service Spatial Data Standard (TSSDS). Traditionally, most real property information was converted to tabular records and stored in a variety of systems to support functions such as landuse planning, site assessments, and digging permits. Recently, the trend at some installations has been to implement a Geospatial Data System where the real property information is stored as electronic base maps and an electronic overlay is created for each functional area (Real Property Master Planning, Range and Training, Engineering, and Environmental). The type of system chosen is usually a GIS because of analytical capabilities, though often the primary use of the system may be CADD type applications. The electronic map overlays depict planimetric features, contours, buildings, utilities, land use constraints, and an increasing variety of environmental conditions. These electronic maps and overlays make it easier to visualize and analyze carrying capacity constraints and opportunities such as land use, infrastructure, range/training areas, and alternative locations, and improve decisions made regarding the use of installation assets.

APPENDIX C:

Background: The Strategies Initiative

BACKGROUND: The Strategies Initiative

Upon receiving the tasking, the first step was to identify a team comprised of government personnel that represented organizations with experience in fielding GD&S solutions within the Army. The team was later named "TEAM GD&S". This term is used interchangeably with the word "team". The team began with five members and was later expanded to include a representative from CPW. The team also gained valuable input about the Range and Training area from Claude Matsui and Mark Flemming.

These individuals were selected for the following reasons:

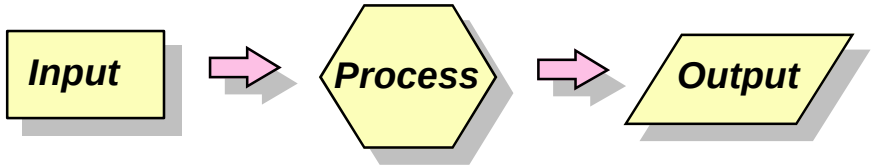
- Their GD&S knowledge, both personal and within their organizations;
- They have been involved in implementation of several of the more mature GD&S systems in the Army;
- They are proponents for the technology and possess a vision for how useful the technology can be for the Army;
- They have displayed a team spirit and a willingness to work together across organizations for the collective benefit of the Army;
- They are knowledgeable of, and/or have provided input to major GD&S initiatives within DOD (Real Property Management Tool (RMAT), Range and Training Land Program (RTLP), Facility Assessment Tracking System (FASTRAC), APMM, Installation Life-Cycle Management (ILM), Environmental Data Management/Decision Support (EDMDS) and others), standards development (FORSCOM's GIS Guide, Tri-Service Spatial Data Standards) and regulations (EC 1110-83-1, FGDC).

Part of the reason for documenting the team's thoughts and ideas is to solicit input from the user community about perceptions and ideas. The team does not claim to have all the answers. They are taking a step forward and writing their observations about what they see based on years of experience within the Army. They are interested in input from other users and/or management related to the issues identified within this document.

Prior to officially forming the team, the members attended meetings and conferences to discuss GD&S issues. The discussions lead to a realization that they were attempting to solve the same problems and shared a common vision. At meetings, they could only talk about issues. When the meetings ended, it was back to the issues at the office. When the tasking came from Headquarters it was not difficult to form a team. It has allowed the team members an opportunity to document what they see happening from a user's perspective for the collective benefit of the Army.

The strategies effort was initiated during the second quarter of FY94. The first Team meeting was held in Fort Worth July 25 through 29, 1994. For the first time the team members were able to see each other's accomplishments and have an opportunity to candidly critique them and other automated management systems in use or under development within the Army. The team hired a contractor, Mr. Tom Speer, ICON Inc. to work with them as a facilitator and to transcribe the information into a concise document. ICON was also selected because of their extensive knowledge with the technology and their "open systems" approach (not being tied to a specific hardware/software platform).

After the first meeting, the team met informally (attended other GD&S meetings with team members) and formally (December 1994, February and April 1995) on several other occasions. Prior to reviewing systems the team adopted a process by to evaluated each other's work. Refer to the Figure on the following page.



What the user must enter into the system (Data).

What the system does to the Data, and what steps are required to achieve the desired results.

What is produced by the system (Maps Reports, Displays, etc.)

The following is a partial list of Army installations where a GD&S, or part of a GD&S was reviewed by the team members:

Fort Bragg's Real Property Master Planning GIS
Fort Stewart's Real Property Master Planning GIS
Fort Polk's Real Property Master Planning GIS
Fort Hood's Real Property Master Planning GIS
Fort Carson (by Intergraph) Modeling of the 4283 Process
Aberdeen Proving Ground, Real Property Master Planning GIS
USARPAC's GIS efforts (An overview by Intergraph):

- Space Planning Analysis Management (SPAM)
- Housing Analysis Maintenance Management System (HAMS), a maintenance module
- Corporate Environmental Management System (CEMS)
- Real Property Analysis and Management (RPAM) Real Estate and Leasing Data
- Automated Surface Danger Zones (ASDZ)
- Access Connection Manager (ACM), Tracks Computer Assets
- Integrated Facility Management, A Seamless Integration of Several of the Above

Red River Army Depot
Lone Star Army Ammunition Plant

Other Installations that the team members were directly or indirectly knowledgeable of:

Fort Lewis
Fort Belvoir
Pensacola Naval Air Station
Edwards Air Force Base
Pope Air Force Base
Dahlgren Public Works

The team also reviewed other automated systems in use within the Army or that have a potential use:

MicroStation Field, (by Bentley) a prototype effort of automation of the DA-4283 form
MicroStation Field Review (by Bentley)
VISION 2000 TAB (by Nakata Planning Group)
VISION 2000 SPACE (by Nakata Planning Group)
Facility Assessment Tracking System (FasTrac) (by R&K Engineering)
Real Property Planning and Analysis System (RPLANS) (by R&K Engineering

The team was not far into the evaluation when their suspisions were confirmed. They were all attempting, in part, to accomplish the same results. They were all making strides to solve the same problems in their own ways without the benefit of consulting with one another about "lessons learned" and approaches.

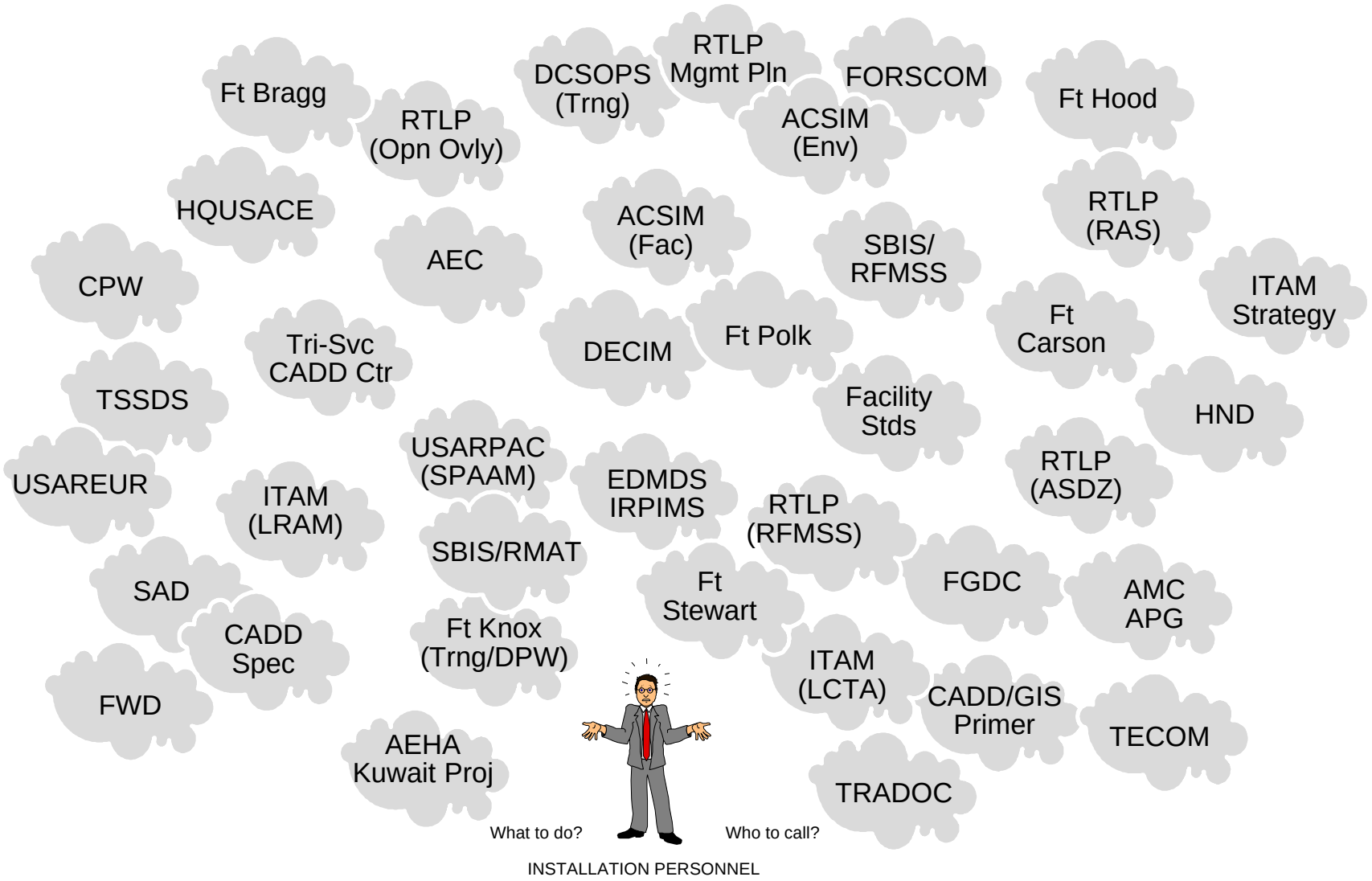
As a result, fifteen common processes were identified at the meeting. The list of processes was later expanded to thirty as follows:

1. Base Mapping
2. Utility Mapping
3. Environmental Overlays
4. Digital Orthophotography and Digital Photography
5. Floor Plan Drafting
6. Space Planning
7. Geospatial Analysis and Query
8. Coordinate Transformation
9. Long Range Component (LRC) Processing
10. Capital Investment Strategy (CIS) Processing
11. Short Range Component (SRC) Processing
12. 1391 Assessment/Impact Processing
13. Range Management/Mapping
14. Quick Location of Graphic Elements
15. Quick Referencing of Graphic Elements
16. Decision Support Reporting
17. Interface with IFS-M
18. Landuse Planning
19. Application of Global Positioning System (GPS) and GIS
20. Pentop Computing and Field Updating for GDS Applications
21. Integration with GRASS
22. Arc/Info Integration
23. Special Project Mapping
24. Integration of AEC Designs for Planning GD&S
25. 4283 Work Order Processing
26. Installation Tab
27. TSSDS Compliance
28. ASIP
29. Real Property Master Planning Process
30. Customized forms and user workflows for data access and reporting.

Some of these processes, or portions of them, were satisfied with some form of automation effort. The team realized that the Army would increase their chances of automating these processes if the GD&S efforts could be built upon one another.

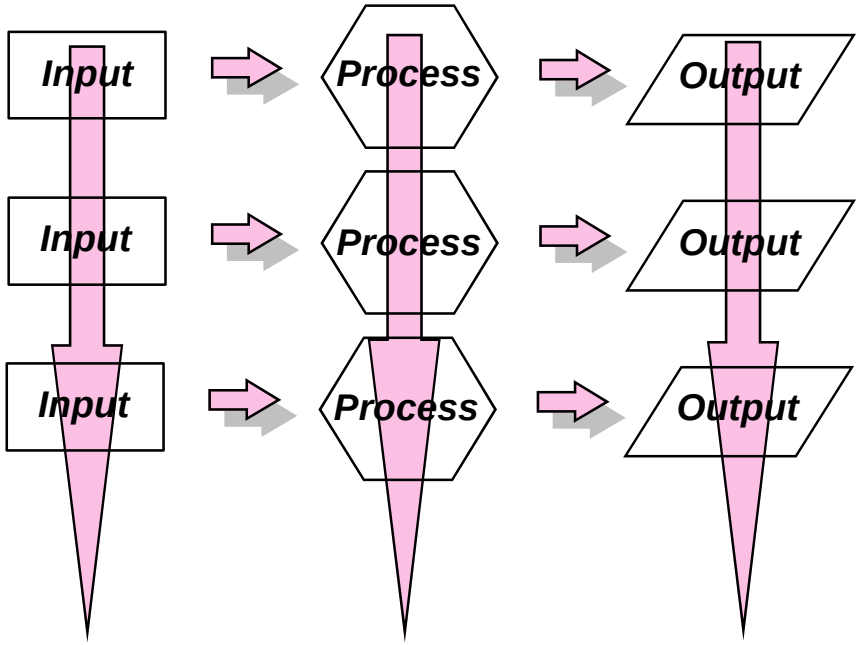
The evaluations also confirmed that many of the Army-wide initiatives are started and finished without attempting to capture the benefit of what has been accomplished at the installation level. Likewise, installation level initiatives are often started and completed without knowing what has been developed at other installations. The team realized that there are no methods for communicating lessons learned and/or needs and requirements from the field, build upon one initiative to the next, or share resources or technical expertise within the Army. The team attempted to identify and create a partial list of individuals who were involved in GD&S initiatives. The result was a diagram similar to the one on the following page.

The most obvious problem resulting in this situation is that there is no leadership or overall guidance within the Army for these many efforts. Where are the lines of communication and the spirit of teamwork? In many cases, the FOAs on the diagram perceived the others as competitors within the Army. The team thought that everyone worked for the same company, the Army. The installation staff are the ones who are impacted the most from this situation. Somehow, through it all, their needs and requirements to accomplish their day-to-day jobs gets lost in the shuffle. As disorganized as the previous diagram is, the team realized that collectively, many of the pieces and answers had been initiated, and that the Army, in general, is out in front compared to other DOD agencies.



Each one of the Army Field Operating Activities (FOAs) in the diagram represent locations that have initiated and/or implemented GD&S programs or projects. The problem, as shown on the diagram, is that there is no method of communicating, partnering or sharing of resources, or building upon each other's efforts for the benefit of the Army. In most cases, each of these FOA's have contributed to the advancement of the use of GD&S technology within the Army.

The team could relate to most of the constraints and opportunities that were identified because they had dealt with them first hand. These issues are not restricted to the Army, and in most cases can be applied within the rest of the DOD and the private sector. The purpose of preparing this document was to capture the team's observations and perspectives and put them in writing. More importantly, the team wanted the opportunity to share ***"grass-roots"*** strategies, which are ideas on how to increase the effective use of GD&S technology within the Army. In other words, these strategies are users' perspectives of issues and some possible solutions.



STANDARDIZATION

There is a requirement for standardized GD&S ***Inputs, Processes, and Output****. Without standardization, everyone develops their own methods of accomplishing similar tasks.*

The essence of the team's collective strategies can be summed up in the following statement:

"Start small, think big and someday get it all."
vs.
"Start big, become small, and get nothing done at all."

APPENDIX D:

Initiatives - Recap of Goals & Objectives

GOALS - "What"

1. Establish leadership roles and responsibilities within the Army with regard to the adoption of Geospatial Data and System implementation.

2. Establish a Corporate Army Geospatial Data and System Strategy.

3. Provide reliable Spatial Data and Systems that are easily accessed and frequently used.

4. Promote seamless integration of technology and mission.

5. Improve mission performance (quality and productivity).

6. Promote sustainability of the technology within Army organizations.

7. Reduce the cost and increase the return on investment (ROI) associated with the development and implementation of Geospatial Data and System technology.

8. Implement an Army GD&S "Regional" Support Plan for military Installations.

9. Develop an awareness and a commitment to the optimum level of GD&S automation required at each installation and the adoption of a regional support plan.

OBJECTIVES - "How to Accomplish Goals"

1. Formulate an evaluation, review and tracking process, based on the "six key" principles (Refer to Chapter 5), that will identify an organization's opportunities and constraints for achieving benefits from implementing GD&S technology.

2. Implement Continuous Process Improvement for refinement and distribution of engineering GD&S workflows.

3. Develop and fund a plan for the Army to implement the Tri-Service Spatial Data Standards (TSSDS).

4. Establish and fund an Army Geospatial Data and System Technology Team.

5. Implement a method to share (co-resource funds and expertise) for GD&S initiatives across organizational boundaries to reduce duplication and develop a set of corporate tools and processes.

6. Identify the critical role of spatial data in one's mission.

7. Establish an awareness in personnel (management and technical) that are affected by the implementation of the technology and the GD&S life cycle.

8. Utilize existing Army and Tri-Service GD&S resources.

MANAGEMENT SUPPORT

GOALS

1. **Obtain** active **management support for** the **implementation of GD&S** technology **at all levels** (functional levels within an installation, Headquarters, Department of the Army, Major Army Commands (MACOMs)).

2. **Identify** and **demonstrate to management** the **benefits** and **r**eturn **o**n **i**nvestment that GD&S technology can produce.

3. Develop strategies for evaluating organizational GD&S outcomes (Army-wide and at the organizational level).

4. Develop an awareness within senior management of anticipated real costs and benefits.

OBJECTIVES

1. Implement an **education program for** various levels of **management** on the benefits and risks of implementing GD&S technology into Army business processes.

2. Develop an **analysis method for evaluating and tracking** (a management tool) **the "6 Key GD&S Principles"** of an organization **relative to** their **opportunities and constraints**. Such an analysis method would become the "yard stick" by which an organization's status and progress could be measured.

3. **Develop "success stories"** in functional areas **where management support does not exist**. Some organizations will require proof that the technology will benefit their business processes and mission.

4. Develop a management/casual user Geospatial Data System **graphical user interface**.

5. Seek third-party evaluations to provide a neutral, objective assessment.

IMPLEMENTATION PLANNING

GOALS

1. Identify and publicize the benefits of developing and maintaining an Implementation Plan.

2. Streamline the GD&S implementation planning process.

3. Establish an umbrella implementation/sustainment plan approach that builds up (tiers) from the installations plan to the subcommands, MACOMs, and the Department of the Army.

4. Develop and maintain an installation level GD&S implementation/ sustainment plan for all installations.

OBJECTIVES

1. Implement a management framework to avoid GD&S resource redundancies within an organization or installation.

2. Document and publish case studies that demonstrate the cost savings that result from following an implementation or sustainment plan.

3. Develop guidelines/tools (decision matrix), procedures and templates (forms or wizards) for streamlining the implementation planning process.

4. Present the umbrella approach (after the implementation procedures are streamlined) to a MACOM to gain a proponent and to prototype the concept at several locations.

5. Apply an incremental implementation approach/technique at several military installations.

6. Provide measurable objectives for GD&S implementation efforts.

7. Develop an awareness and focus on the non-technical issues related to implementation of the technology.

8. Establish periodic senior management progress briefings during implementation.

9. Involve the end-users throughout the implementation process.

RESOURCE ALLOCATION (Manpower)

Goals

1. **Plan, identify**, and **commit** the **manpower** required **to support** the appropriate level of **GD&S implementation** within the organization(s) (installation, HQs, MACOM, etc.).

2. **Define** the **optimum** amount of **in-house manpower to maintain the GD&S** systems at installations.

3. Establish **career opportunities relative to** a person's level of technical **GD&S expertise**.

4. Establish **incentives to retain GD&S expertise in the Army** (see Section 10 Training/Experience).

5. **Share telecommunication resources** and technical **staff** across organizations.

Objectives

1. **Match manpower requirements to** the **tasks** identified **in** the implementation **planning process** for each organization(s).

2. **Acquire manpower** for an installation or specific organization(s) **via a combination of approaches** (in-house staff, Corps Districts, Laboratories, contractors and academia). The approapriate combination will vary from installation to installation.

3. Use a **co-resourcing** approach **across organizational and regional boundaries for** acquiring technical **manpower** as a vehicle for technical transfer and mentoring of GD&S knowledge within the Army.

4. **Acquire** the optimum **GD&S** in-house **expertise at** all **installations**.

5. **Establish** and fund an **Army Geospatial Data System** technology team **to facilitate technology transfer and support Geospatial Data System development and implementations**.

6. A mission purpose should be established for an Army **GD&S** technical **group to assist** in the **management and execution of the co-resourcing of manpower** (within the installation's boundaries and beyond).

7. **Consult with** Army and Tri-Service **peers** before contracting for GD&S services.

8. **Develop** a **management framework** to promote and facilitate the **sharing** of **resources across organizational boundaries** for the benefit of the "total" installation.

RESOURCE ALLOCATION (Funds)

Goals

1. **Build** an **investment strategy for funding** the appropriate level of **GD&S implementation** within the organization(s) (installation, HQs, MACOM, etc.).

2. **Determine** the **costs and benefits** (related to all six principles) **of implementation and sustainment** of the technology.

3. **Increase** the **use and application** of project orders **(multi-year funds) for GD&S** efforts.

Objectives

1. **Co-resource program funds across organizational boundaries** (functional areas on an installation or from one installation to the next, HQs, MACOMs, etc.) **for** implementation and sustainment of **GD&S** when it adds value to the customer's product.

2. **Co-resource project funds across organizational boundaries for** implementation and sustainment of **GD&S** when it adds value to the customer's product.

3. **Perform a cost/benefit analysis** of the implementation of the technology at the installation, **prior to investment** (see Appendix F).

4. **Demonstrate, document and promote** the benefits of using project order **(multi-year) funding** for GD&S projects.

5. **"Manage to budget"** - Stay within budget for a tasks and programs. Manage the dollars not the manpower.

6. **Program funds from multiple agencies (ACSIM, HQUSACE, CPW, MACOMs, etc.) to support the GD&S technology group.**

7. Coordinate obligation of available end-of-year monies with implementation/sustainment plan.

RESOURCE ALLOCATION (Time)

Goals

1. **Plan** for, **identify**, and **commit** the **time** required to support the appropriate level of GD&S implementation within the organizations (installation, HQ, MACOM, etc.).

2. **Provide intermediate products** and return on investment **during** the **implementation** of the technology.

3. **Reduce** the **time** required **to implement** new technology.

Objectives

1. **Determine** the **time** (hours per day, week and year) **required for** the installation staff to **sustain** the GD&S **technology**. Then obtain the commitment from management to staff accordingly (see Manpower, Objective no. 1 for methods of accomplishment).

2. **Develop** an **awareness** and **commitment to** the amount of **time** required to implement and sustain the technology within the organization(s).

TECHNOLOGY INVESTMENT

GOALS

1. **Implement** a **root technology** approach **as a corporate solution** for investment in the **technology**.

2. **Increase** the **fidelity, usability and accessibility of data**, via investment in the technology.

3. **Create** an **environment** where the **GD&S users drive the technology**, not where the technology drives the users.

OBJECTIVES

1. **Identify a process to define, test and validate** the components of a **"corporate" toolbox** (graphic and database engines, operating systems, user interface tools, etc.) **for** the development of applications and implementation of **root technology**.

2. **Approve and implement a process** (see Objective No. 1) for **sustainment of "root technology"** for the Army.

3. **Develop the criteria and process** for the **investigation and determination of local solutions** (processes, products, etc.) that **support a corporate Army solution.**

4. **Standardize processes** around the common geospatial data to **avoid duplicate development costs.**

5. **Identify, prioritize and fund** the corporate investment needs that enhance the **interoperability of data across** multiple Standard Army Management Information Systems **(STAMISs) and** the existing **installation** level **geospatial data systems**.

6. **Develop a methodology** that **identifies** the **existing installation systems** that will "plug" into an Army corporate approach, **prior to funding any new initiatives** for similar purpose.

7. **Define and apply** the concept of a **"Root Technology"** approach **to** the development of **Army** GD&S **applications**.

8. **Develop a process** by which the Army can **provide leadership to** the **commercial developers** of GD&S technology **for Army programs or applications**.

9. Establish **Army Geospatial Data System leadership** (technical review board or users) **to guide commercial development**.

10. **Solicit input** from **experienced GD&S** technical **personnel** in lieu of making quick procurement decisions.

11. **Investigate procurement options** (outside typical organizational boundaries) for available federal contracts and technologies.

12. **Determine** the GD&S **application first, then procure** the equipment to meet the needs of the application.

13. Encourage **cooperative ties** with the **Directorate of Information Management** (IM) activities.

TRAINING/EXPERIENCE

GOAL

1. Establish a knowledge base of technical in-house expertise at multiple levels (Department of the Army, MACOMs, installations etc.) within the Army.

OBJECTIVES

1. **Identify and** maximize the **use** of the **existing** centers of expertise (Installations, Districts, Labs, etc.) in the Army.

2. **Identify** the **existing areas** of **in-house expertise** and develop a **plan for mentoring** this **expertise** to other FOAs that provide military installation support.

3. The existing expertise **centers** should **work together to** develop a process to **mentor** GD&S **skills** and to facilitate **technical** transfer across multiple organizations **for** the purpose of **installation support**.

4. **Identify** the **opportunities** and **constraints** for **regionalizing** GD&S **support** services to installations.

5. Officially **sanction, fund** and **empower** an Army **technical team** to facilitate the achievement of objectives 1-4.

6**. Develop technical career paths** (opportunities) in multiple levels of the Army, **based** on a person's **GD&S technical knowledge**, skills and abilities (**KSAs**).

7. **Develop** a validation **process** or certification criteria for the **GD&S KSAs required** for the different **levels** (1-4 Reference item "C") of users.

8. **Establish** a **training guide** for people to meet the KSAs required for each level of GD&S user (Reference item "C").

9. **Match** the **technology with** available **skills of** the **organizations' staff**.

10. **Coordinate training with availability** of the user's **data** and **hardware**.

DATABASE DEVELOPMENT

GOALS

1. **Maximize** the **return on investment and usability** of **data collection** efforts for geospatial data systems.

2. **Develop** a virtual **corporate database** that is **driven by use and accuracy**.

3. **Balance** the **data** (amount and cost) **to** your **needs**.

OBJECTIVES

1. **Identify, analyze** and **prioritize** your **data needs**.

2. **Share resources and data** needs for maximum return on investment (ROI).

3. **Prioritize and collect** data **based** on the number of **users that** can **benefit** from the use of the data.

4. **Develop Data-Application-User-Models** for each product to be produced with a geospatial data system (refer to Appendix F).

5. **Collect data once and share it among multiple users**. As the "need to know" arises, the functional area responsible for managing the data should update the data.

6. **Determine** the **data** and **accuracy** required **for corporate use**. Functional areas (responsible for managing specific information) will typically require a more detailed degree of accuracy and completeness than corporate (casual) users.

7. **Establish** and **maintain** a **corporate repository** (library of spatial data) at installations.

8. Develop and **implement techniques to avoid re-inventing** the same data for multiple users.

9. **Utilize** the **"root technology"** tool box to develop the databases.

10. **Determine** data **collection priorities based on** the following three **issues**:

* regulatory requirement
* the frequency of the data access
* The numbers of users who need the data

11. **Establish** an **approach and process** that will create opportunities **for partnering and co-resourcing between** the **Army and** the **private sector** for the development and implementation of Army GD&S applications.

APPENDIX E:

Terminology and Definitions

Terminology and Definitions

ACSIM	Assistant Chief of Staff Installation Management.
A/E	Architect/Engineering firm.
AM/FM	Automated Mapping/Facilities Management.
Benchmarking	A process of testing two or more applications to determine whether they will meet the specific requirements.
CADD	Computer-Aided Drafting and Design.
CESWF-PL-E	Corps of Engineers, Fort Worth District, Planning Division, Economics, and Master Planning.
CEMP-EA	Corps of Engineers, Directorate of Military Programs, Engineering Division, Architectural and Planning Branch.
Co-resourcing	A concept of partnering across Army organizations (MACOMs, installations, directorates within an installation, labs, engineering districts, etc.) to share technical resources and funding.
Database	A collection of information organized for retrieval. The information can be manipulated by a user or computer program to present the information in summary reports.
Database Development	The required graphic and tabular information collected and converted into a data model for a geospatial data system.
DOD	Department Of Defense.
EC	Engineering Circular.
Facility	A separate, individual building, structure, utility, or other form of real property, including land.
FASTRAC	Facility Assessment Tracking System.
GD&S	Geospatial Data and Systems.
Geospatial Data	Data that defines natural and man-made features and that is referenced to a mapping coordinate system.

GIS	Geographical Information System. A computer system used to store, retrieve, manipulate, and present spatial data and other referenced data using absolute, relative, or assumed coordinates.
Implementation	The preparatory planning tasks required to successfully install and operate GD&S technology within an organization.
Installation	Army military reservation, facility, and range. A continuous land mass.
Integration	The combining of two or more applications so that they can share the same geospatial data and graphical user interface.
Interoperability	The linking of two or more applications so that they can share the same geospatial data.
ITAMS	Integrated Training Area Management System.
LIS	Land Information Systems
MACOMs	Major Army Commands.
Pilot Project	A project used to complete a sample of functionality from applications that an organization wants to implement.
Resource Allocation	The time (when), manpower (who), and funds (how) required to implement and maintain GD&S technology.
RMAT	Real Property Management Tool.
ROI	Return on Investment.
Root Technology	The basic graphic and database engines that enable users to create drawings and maps and link the information together.
RTLP	Range and Training Land Program.
STAMIS	Standard Army Management Information System.
Technology Investment	The required hardware and software that an installation must purchase to establish a GD&S platform.
Technology Transfer	The process of identification and transfer of accomplishments (products, processes, standards, lessons learned, etc.) between Army organizations.

Training and Experience	The skills that must be acquired by installation personnel to effectively utilize GD&S technology.
TSSDS	Tri-Service Spatial Data Standard.
USACE	U.S. Army Corps of Engineers.
Workstation	A computer terminal that contains a processor, software, and data, that can operate in a standalone mode or as part of a network.